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DEVELOPMENT OF GEOTHERMAL RESERVOIRS FROM OVER-PRESSURED AREAS BENEATH THE GULF COASTAL PLAIN OF TEXAS. A FEASIBILITY STUDY OF POWER PRODUCTION FROM OVERPRESSURED RESERVOIRS

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Eugene Herrin

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Southern Methodist University

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A Feasibility Study

of

Power Production from

Overpressured Reservoirs

Department of Geological Sciences

Southern Methodist University

March 1973

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SUMMARY

Below depths of 6000 to 10,000 feet, sediments in Tertiary basins are commonly characterized by abnormally high pressures and temperatures and low salinities. Such zones are called geopressured zones and are known to occur worldwide. Geopressured areas occur in continuous belts, are commonly bounded by regional faults, and extend hundreds of miles. The belt in the northern Gulf of Mexico basin is about 750 miles long, extending from the Rio Grande of Texas to Mississippi Sound. It underlies the Coastal Plain inland from 60 to 100 miles, and underlies the Continental shelf up to 150 miles offshore.

The overpressured waters located at depth in the Gulf Coast and in similar Tertiary basins throughout the world represent a possible source of electrical power. It is the purpose of the present study to determine the feasibility of locating a pilot project in the Texas Gulf Coast area for the purpose of tapping the overpressured aquifers and transforming the thermal and mechanical energy into electrical power.

Three areas in South Texas were given particular attention for their feasibility of being the site of the pilot project. These are the Sebastian area in northwest Cameron County, the Port Mansfield area in eastern Willacy County, and the Corpus

Christi area. Logs taken from deep oil wells in these three areas were analyzed to determine formation pressure, temperature, and salinity as a function of depth. This analysis indicated that large aquifers were present beneath both the Sebastian and Port Mansfield sites. At about 15,000 feet, aquifers were detected which have temperatures in excess of 300° F, formation pressures greater than 10,000 psi, and salinities less than 20,000 ppm. Growth faults compartmentalize each of the areas into structural traps of areal extent in excess of 300 square miles.

Careful environmental studies of both the Sebastian and the Port Mansfield sites indicate that the construction and 5-year operation of a pilot plant would have no significantly bad environmental impacts in either area.

We conclude that it is feasible to construct and operate a pilot plant for electrical power production from a single well in south Texas. Over four megawatts of power could be produced from a single well; two billion cubic feet of methane would be produced as a by-product. Based on geological and environmental considerations, we find it feasible to locate the project in either the Sebastian or Port Mansfield areas.

INTRODUCTION

Tertiary (age less than 80 million years) basins filled with clastic sediments (sand and clay or shale) are generally undercompacted below depths of 6,000 to 10,000 feet. The interstitial fluid pressure reflects a part of the overburden load, and the deposits are said to be geopressured. Aquifer systems within the geopressured section are compartmentalized by regional faults into blocks of horizontal extent ranging from tens to thousands of square miles. Interbedded clay or shale commonly has a porosity 6 to 8 percent greater than it would have if fully compacted at its depth of occurrance. The <u>geostatic ratio</u> (the ratio of fluid pressure to pressure of the overburden load) is commonly 0.7 to 0.9 in the geopressured zone, which extends downward to the zone of metamorphism. Geopressured sections have been penetrated by thousands of wells.

Geopressured deposits occur in continuous belts, are commonly bounded by regional faults, and extend hundreds of miles. The belt in the northern Gulf of Mexico basin is about 750 miles long, extending from the Rio Grande of Texas to Mississippi Sound; it underlies the Coastal Plain inland 60 to 100 miles, and underlies the Continental Shelf wherever drilled up to 150 miles offshore.

Geopressured deposits are hotter than normally pressured deposits because upward loss of the included water has been essentially stopped for millions of years. Water is a poor conductor of heat (thermal conductivity about 20% of that of the associated mineral grains) and undercompacted clay is an excellent thermal insulator. In addition, the specific heat of water is about 5 times greater than that of the associated mineral grains. Thus, geopressured deposits greatly reduce the geothermal flux above them, and store geothermal heat. The geothermal gradient is sharply increased near the top of the geopressured zone (the <u>hydraulic boundary</u>), and the geopressured deposits form a sort of "pressure cooker". In this setting, thermal diagenesis of expandable clays liberates the bound and intracrystalline water, and the free pore water thus formed may equal 30 percent of the volume of the unaltered clay. This new free pore water is fresh. As it drains into adjacent sand-bed aquifers, it flushes the more saline water upwards towards the top of the geopressured zone. Aquifers a few thousands of feet below the top of the zone commonly contain water having less than 10,000 mg/l of dissolved solids. In some places, the water is potable (less than 1,000 mg/l).

Sand-bed aquifer systems in the geopressured zone have permeabilities ranging upwards of 25 millidarcies; the viscosity of the water is commonly 0.2 to 0.3 centipoise; and the water is a chloride-bicarbonate type, slightly alkaline (pH 7.5 to 8.5). Because the solubility of hydrocarbon gases in water increases rapidly with decreasing dissolved solids and because the high temperatures and pressures have resulted in a natural cracking of petroleum hydrocarbons, the geopressured reservoir waters commonly contain 10 to 16 standard cubic feet of natural gas per barrel of fluid (approximately 1/2 cubic feet per gallon of water). Dissolved hydrocarbon gas would be a valuable by-product of fluid production.

Production history of geopressured reservoirs (mainly for natural gas production) indicates that there is replacement of produced fluid by water from undercompacted shales that bound the reservoir. There is no consistent relation between volume of produced fluid and resultant reservoir pressure. Repressuring of the reservoir occurs, to some degree, whenever production is stopped. It is apparent that production of water in geothermal developments would effectively drain the undercompacted shales bounding the aquifer tapped, but that reservoir pressures would be appreciably depleted only over a long production history, provided

the size of the reservoir were at least several hundred square miles.

Temperatures of produced water would range from 150 to 180°C; well head pressures would range from 4,000 to 6,000 psi; and production rates would be several million gallons of water per day for each well.

WORLD-WIDE OCCURRENCE OF GEOPRESSURED RESERVOIRS

Formation pressures higher than hydrostatic have been encountered in the worldwide search for oil and gas in many countries. We believe that increasing exploratory efforts in new areas, both onshore and offshore, and the general trend to deeper drilling will further broaden the areas where abnormally high formation pressures are encountered, causing drilling, completion and production problems. To our knowledge, geopressures have been encountered worldwide. Figure 1(from Fertl, 1972) shows the worldwide occurrence of abnormal formation pressures. Areas include: the recently much publicized Arctic Islands; the U.S.A.: such as Arkansas, California, Louisiana, Oklahoma, Texas, and Wyoming; Mexico; in South America: Venezuela, Trinidad, Columbia, Argentina; in the Far East: Japan, New Guinea, Indonesia, South China Sea, Burma, and India; in the Middle East: Iraq, Iran, and Pakistan; in Africa: Algeria, Morocco, Nigeria, and Mozambique; in Europe: Austria, France, Germany, Holland, Italy, Hungary, Poland, Rumania; and in the USSR: such as in the Ukraine, in Cis-Caucasia, on the Apaheron Peninsula, and the Prikurine Lowlands of Azerbaidzhan, in the west of Turkemeniya, in the Bukhara area of Uzbekistan, along the Volga, in the Urals and the Ural region.

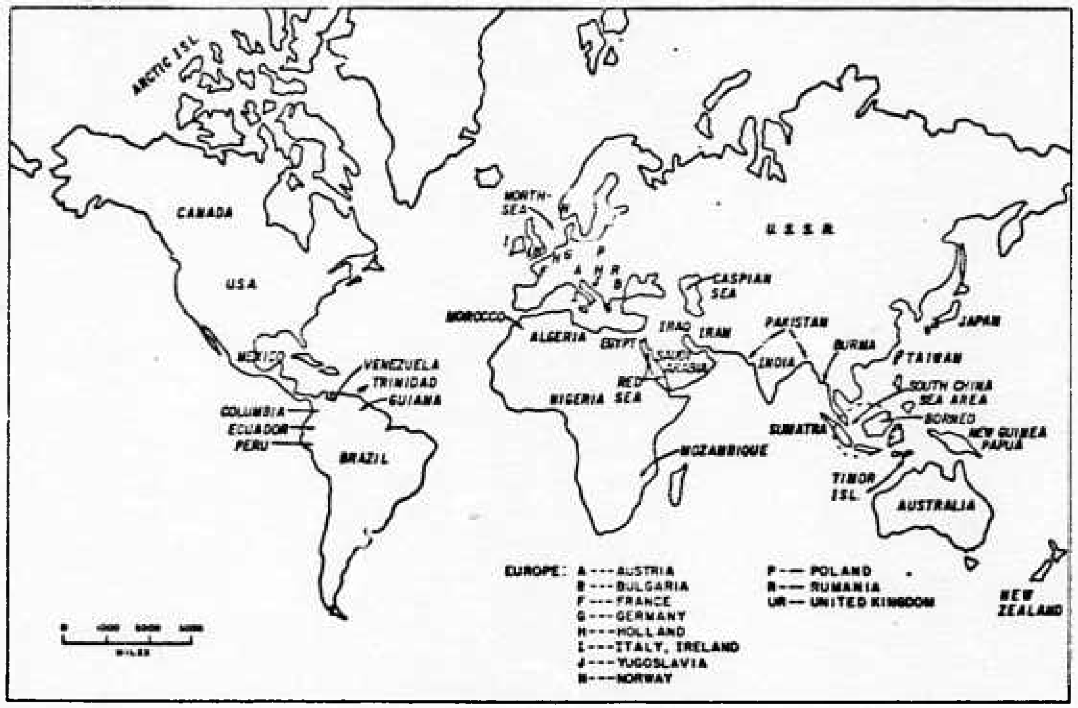


Figure 1: World map of deep tert:iary clastic basins (after Fertl, 1972)

blowouts, and casing collapse.

South China Sea Region (Clark AB, Phillipines). Recent studies have shown several large sediment-filled basins separated by swells and ridges. The sediments are thick and contain many trap structures such as faults, unconformities, and diapiric intrusions. Drilling problems have included abnormally high geothermal gradients (2-3°F/100 ft.) and abnormally high formation pressures, which vary greatly in magnitude. Off-shore, several blowouts caused by overpressured gas pockets have occurred at depths as shallow as a few hundred feet and as deep as several thousand feet. For example, in 1970 four major blowouts were reported in the subject area. Controlling one of these wild wells required two relief wells.

Taiwan. Abnormally high formation pressures occur in the Chuhaunkeng formation of Middle Miocene age. Abnormal pressure environments have also been observed in the Chinshui, Chuhuangkeng, and Tiehchenshan-Tunghsiao gas and oil fields.

Japan. The Nagaoka Plain, one of Japan's most actively explored areas, is located on Honshu, northwest of Tokyo. The main hydrocarbon reservoirs are in volcanic and pyroclastic rocks. The reservoir rocks exhibit a wide range of formation pressures, with the higher pressure zones occurring beneath the low permeability mudstone cap rocks.

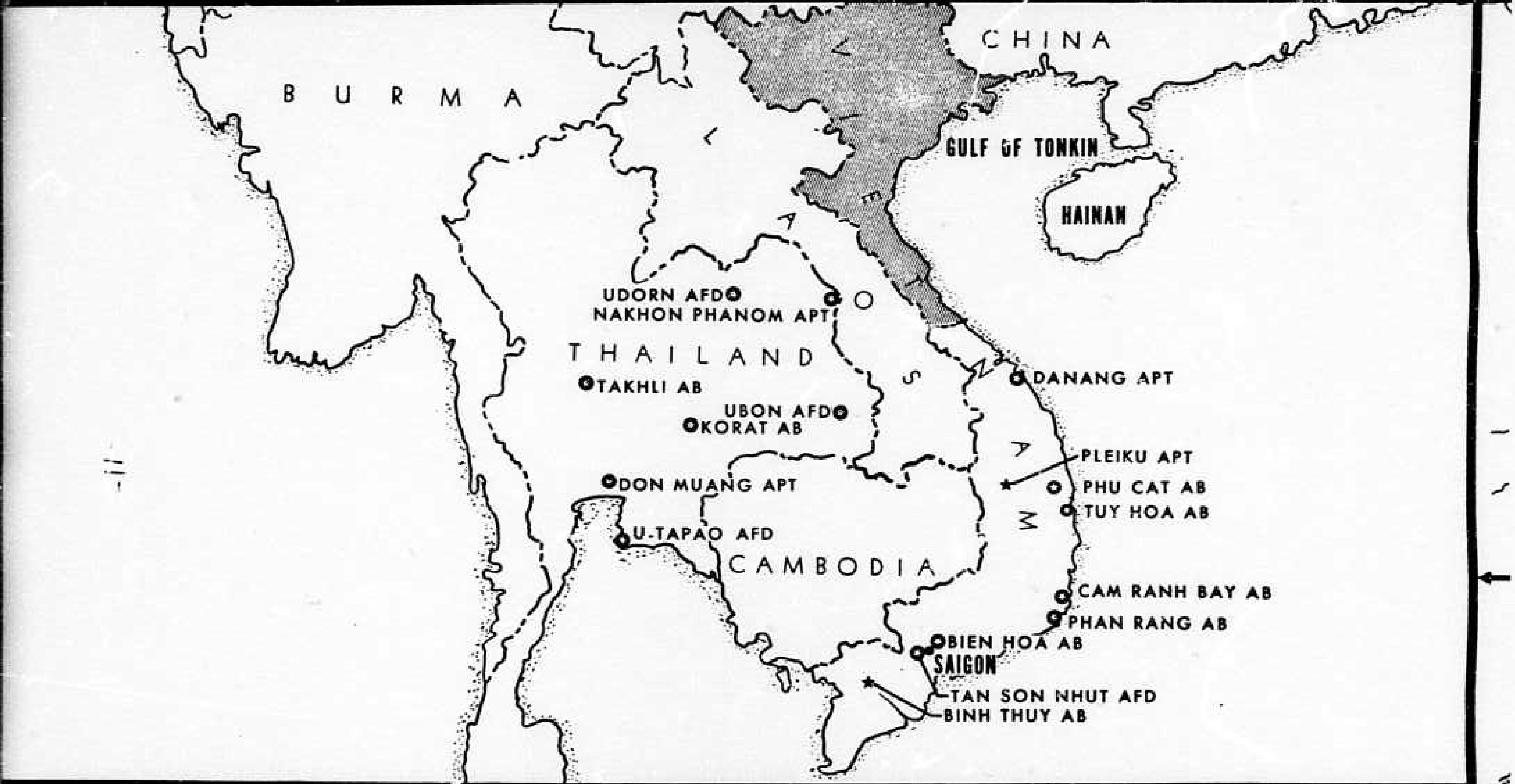
Figures 2(a), 2(b), 2(c), and 2(d) show the locations of the major installations of the United States Air Force (outside of the continental United States) as of 1 July 1970. The locations of the Air Force installations can be compared with the distribution of the known abnormally pressured zones shown in figure 1. Those countries or areas in which both U.S.A.F. installations are located and in which abnormally pressured sediments have actually been encountered by drilling are Holland, W. Germany, Berlin, Italy, South China Sea, Alaska, Canada, Taiwan, and Japan.

Fertl (1972) gives a brief discussion of each of these areas as follows:

West Germany. Drilling activity over the last decade has been concentrated in the northwest German Basin and the Bavarian Basin. The German Basin covers most of northern Germany, with New Amsterdam AB being located near its southwest edge and the Templehof Apt. (Berlin) being near its eastern edge. The Bavarian Basin is the northern foreland of the Alps, encompassing several of the bases in southwest Germany.

Numerous German wells have encountered abnormal pressures, causing drilling problems and blowouts. Abnormal pressures are mainly due to the presence of salt domes, salt diapiric structures, and/or large salt masses. The salt masses are known to have a lateral extent of hundreds of miles and overlie overpressured

SOUTHEAST ASIA



USAF MAJOR INSTALLATIONS

OUTSIDE CONTINENTAL U.S.

AS OF 1 JULY 1970

○ USAF ACTIVE MAJOR INSTALLATIONS ★ USAF DOB OR MAJOR ACTIVITY

AFVA 55-2, 1 JULY 1970 — DISTRIBUTION: F

Figure 2(a)

PACIFIC AREA

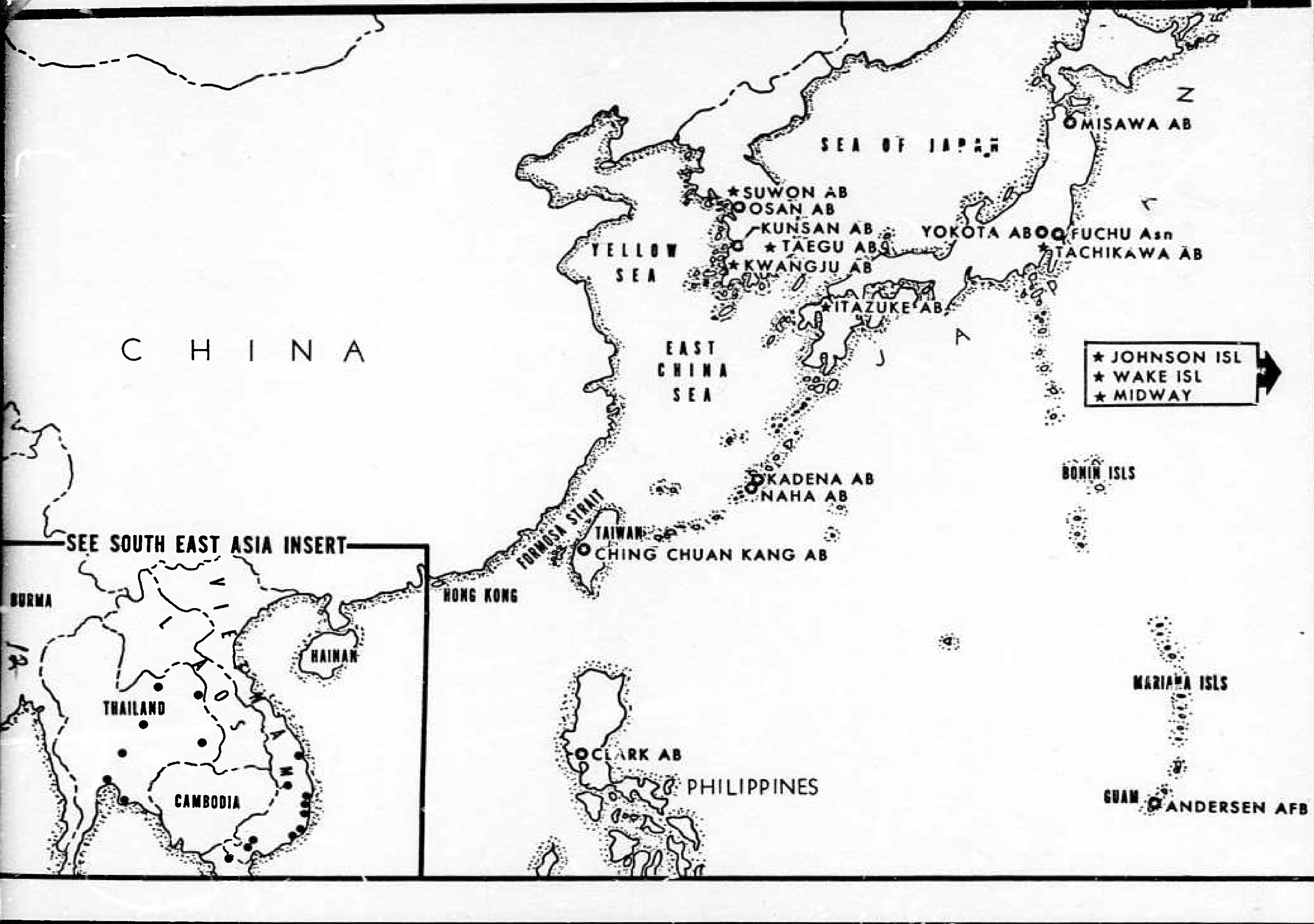


Figure 2(b) USAF Installations

GPO 895-680

Figure 2(c) USAF Installations

EUROPE - AFRICA - MIDDLE EAST

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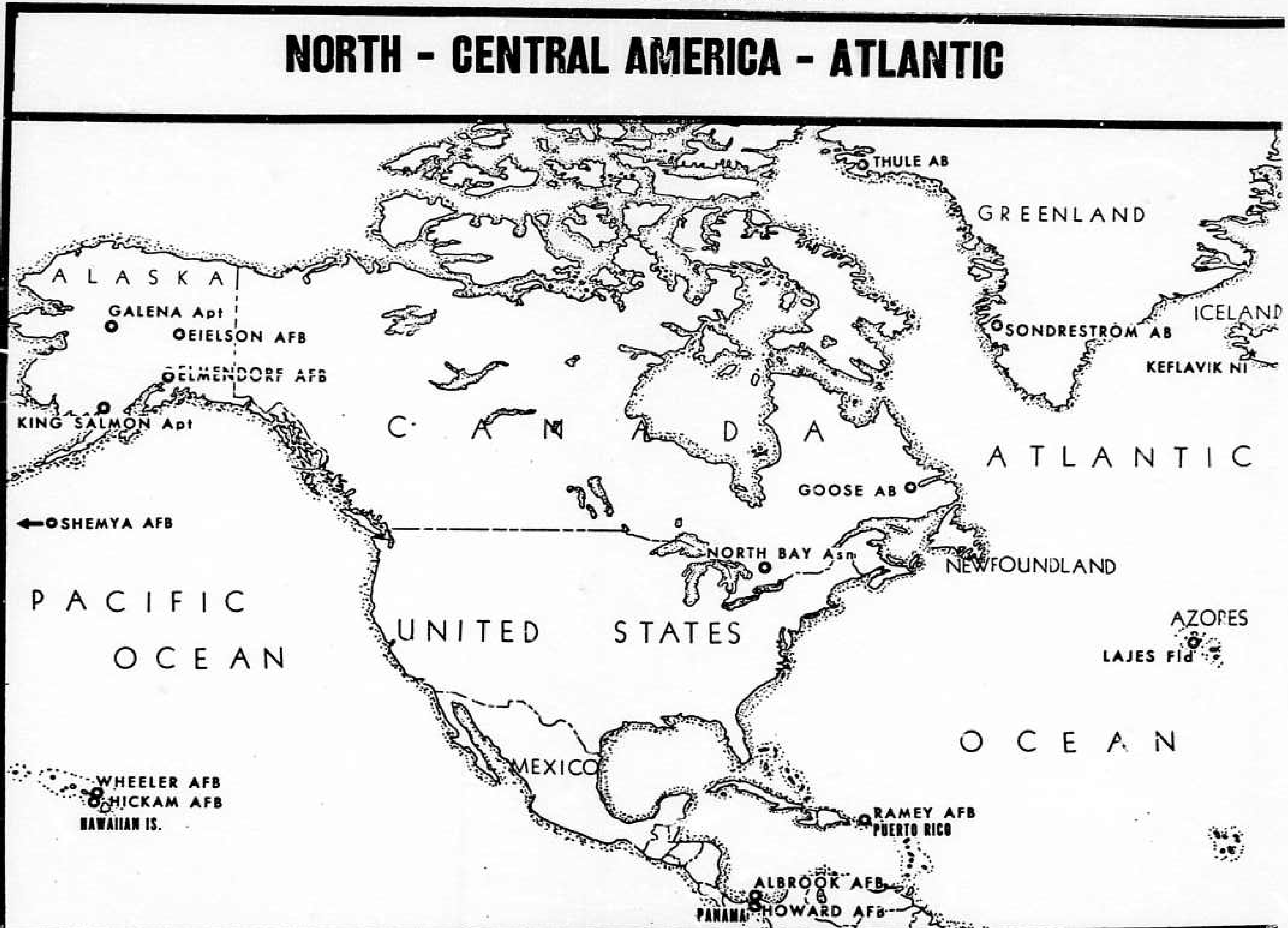
Figure 2(d) USAF Installations



Permian shales, which in turn overlie Permian potential reservoir rock. By 1969, there were over 80 high-pressure wells producing gas from the Rotliegendes and Zechstein formations. The Zechstein evaporative section is particularly well known for causing well control problems due to high pressure.

Holland (on-shore). The previously mentioned northwestern portion of the German Basin consists of several smaller troughs, the oil and gas-bearing lower Cretaceous and Tertiary formations of the West Netherlands Basin being separated from them by a swell region. One of the world's greatest gas reserves has been discovered near Groningen. The Groningen gas field covers about 195 square miles, with several thousand feet of Zechstein evaporites forming the sealing cap of the over-pressured gas reservoir of basal Permian Rotliegendes sandstone.

Italy. For many years, oil and gas have been produced in the Po Basin of northern Italy. This Basin includes the Venice region and also Aviano AB. It is filled with sediments of marine Pliocene and Quaternary. The Po Basin's off-shore potential has recently been recognized and tapped. In addition, The Apennine Foredeep, located on the Adriatic side of the Italian peninsula and extending as far south as the Gulf of Taranto, has been the scene of substantial discoveries of hydrocarbon deposits. In all these areas, abnormal pressure environments have caused drilling problems,

Canada. Abnormal formation pressures have been encountered in several regions, including the Rainbow Lake area (western Canada).

Alaska. Abnormally pressured zones are common in the North Slope.

Only USAF installations outside of the continental United States have been considered in the preceding discussion. We expect that there are a number of other U. S. military or naval installations which are located in areas underlain by overpressured, geothermal reservoirs.

The occurrence of geopressured reservoirs in deep, young sedimentary basins was discovered by accident as drilling for petroleum reached depths of 10,000 feet or more. Discovery of very large gas and distillate reserves in the geopressured zone led to widespread exploration of the zone and the development of highly effective methods of predicting the depth to the top of the zone, and the pressure gradient within it. Knowledge of these parameters is critical to the successful drilling of the geopressured zones; many costly blowouts, fires, and lost holes resulted before the prediction technology was developed.

The top of the geopressured zone has been mapped throughout most of the Gulf Coastal Plain and Continental Shelf; these maps are company confidential, but data can be obtained on any locality

from several of the major operators. Similar data are avialable for geopressured reservoirs throughout the "free" world.

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WESTERN GULF COAST REGION

The Western Gulf Coast Region has been selected as the region for location of the pilot geothermal well. Reasons for selecting this area are several. (a) The area is representative of the thick Tertiary clastic sections which are developed in numerous basins around the world. (b) Onshore and, more recently, offshore, petroleum exploration has been incredibly intensive in the Tertiary of the northern and western Gulf Coastal Plain. Subsurface data are correspondingly very abundant and accessible. (c) Geopressured zones are relatively common, both stratigraphically and regionally, thus simplifying the task of locating a site for initial experimentation. We believe that information derived from studies of the Western Gulf Coast Region can be used to construct a model which should apply to overpressured, geothermal reservoirs in other areas.

Three specific areas in the Western Gulf Coast Region were selected for determination of their feasibility as the site for a pilot geothermal well. These areas are shown in figure 3, where they are designated as (1) the Sebastian site; (2) the Port Mansfield site; and (3) the Corpus Christi site.

The subsurface temperatures and salinities of the northern Cameron County area in which the Sebastian site is located have

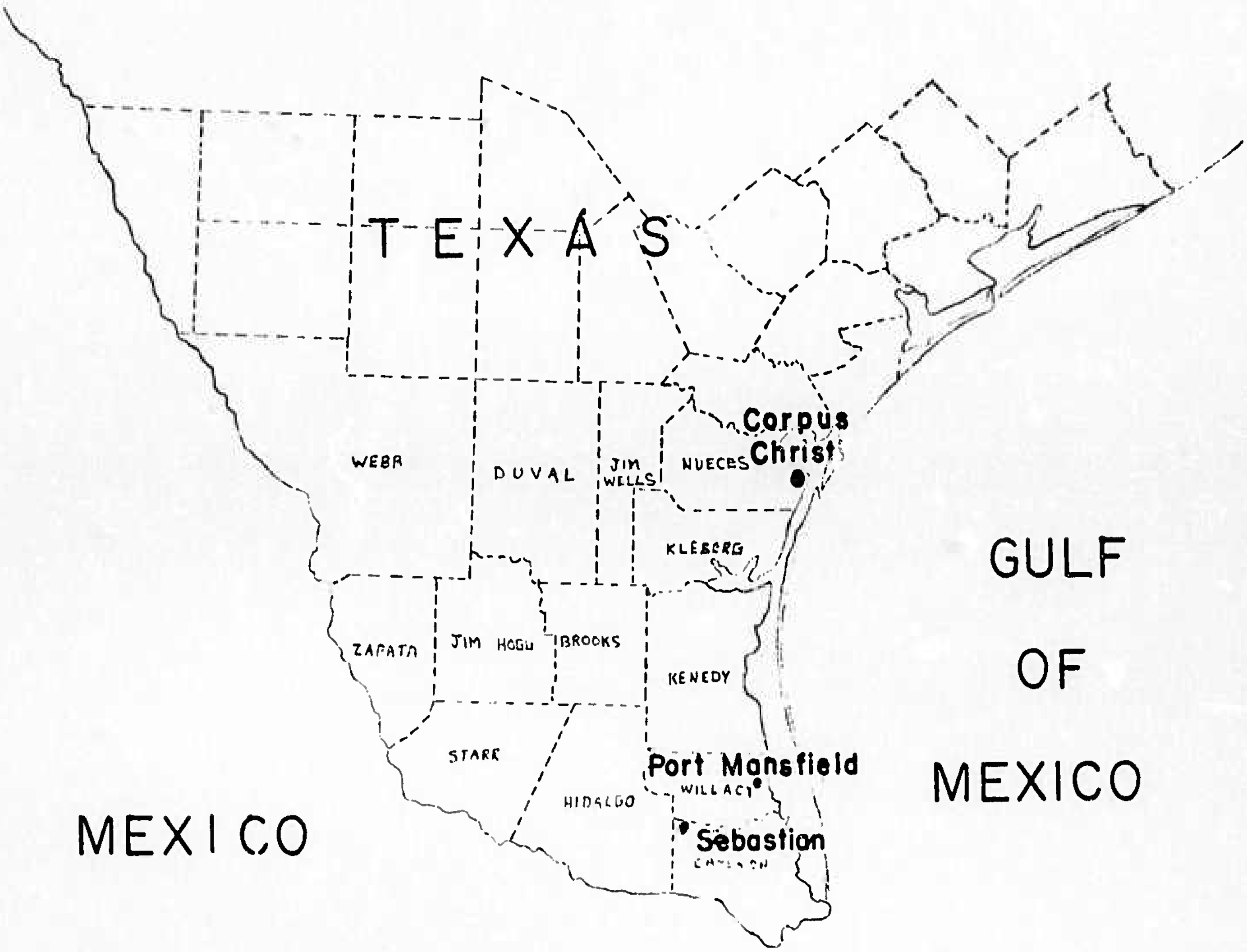

Figure 3: Map of Texas Gulf Coast

been previously studied by the United States Geological Survey (Jones, 1969b). Jones has identified the area as one of high temperature and low salinity. The area surrounding the Port Mansfield site has been identified by the United States Geological Survey (Jones, 1969b) as one of the spots in the Western Gulf Coast Region where the 300° F isogeotherm most closely approaches the surface (about 13,000 feet). The Corpus Christi site was included for study because of the potential logistical value of being able to use Cabiniss Naval Air Station for the pilot program.

Definition of Province

The area of investigation is located in the Gulf Coastal Province of North America. Much of the following discussion of this province has been taken from the excellent reviews by Murray (1961, 1963).

A coastal geosyncline containing great thicknesses of partially exposed Mesozoic and Cenozoic rocks exists along the northern and western margin of the Gulf of Mexico. These sediments lie on a relatively complex basement surface of Paleozoic and Precambrian rocks. The Paleozoic and Precambrian units were moderately to highly deformed and metamorphosed during the Late Paleozoic and were compressed into the presently largely subsurface Ouachita fold belt (fig. 4). The basement surface and the overlying Mesozoic and Cenozoic rocks have a relatively gentle

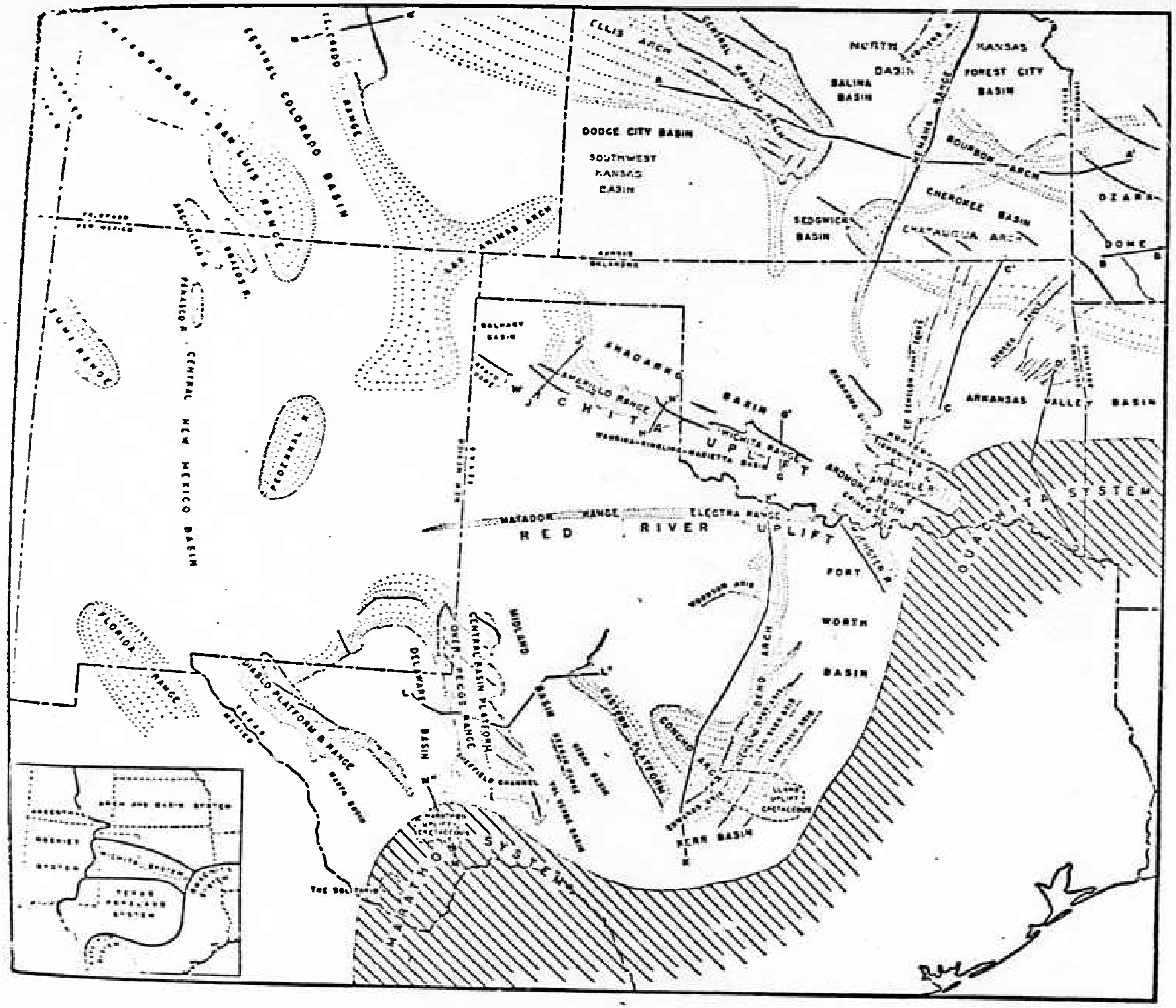

Figure 4: Subsurface Ouachita fold belt (after Eardley, 1951)

homoclinal dip towards the south, and are situated on the south flank of the stable cratonic interior of the continent. Large positive and negative warpings, faults, and salt and igneous masses have modified the overall homoclinal dip and cause variations in (a) the width of the plain, (b) the topography and landforms, and (c) the nature and character of present day shorelines.

The Cenozoic strata, with which this report is concerned, crop out in subparallel belts which are progressively younger seaward. Structurally these rocks are relatively undeformed. Where it does occur, deformation is largely or entirely gravitational and tensional. The geosynclinal sedimentary mass is lithologically variable, roughly lenticular in cross-section, and achieves maximum thicknesses of 50,000 feet or more in both the northern and southern Gulf of Mexico. This three-dimensional structural-stratigraphic or geologic unit is termed the "coastal province" (Murray, 1961). Much of this province, therefore, is submerged beneath the shallow continental shelf or deeper waters of the Gulf. The "coastal plain," in contrast, is a topographic or geomorphic feature of low relief with elevations generally below 1000 feet. Surface drainage within the coastal plain is entirely into the Gulf of Mexico.

Murray considers the coastal province as an entity which has accumulated in Mesozoic and Cenozoic times in the actively subsiding southern margin of the continent and, indeed, around the periphery of the Gulf of Mexico, it includes all geologic units which either have had a continuing relationship to, or are now an intimate part of, this subsiding province. Technically, the coastal province of the Gulf of Mexico is continuous with the Atlantic coastal province. We will, however, confine our discussions to the Gulf region, and specifically to the northern and western Gulf coastal province of Louisiana and Texas and adjacent offshore areas.

Three major structural sags in the study area have produced the following physiographic embayments into the continental mass: Mississippi Embayment, East Texas Embayment, and Rio Grande Embayment (fig. 5). The inner margin of the Gulf coastal plain as traced westward from central Georgia to the Brazos River of Texas is essentially coincident with the inner (landward) extent of Mesozoic and Cenozoic sediments. Southward from Waco it follows the Balcones escarpment to the Rio Grande in the vicinity of Del Rio, Texas. Thus, the inner margin of the coastal plain, west of the Brazos River, stratigraphically approximates the contact between the Cretaceous Gulf and Comanche series.

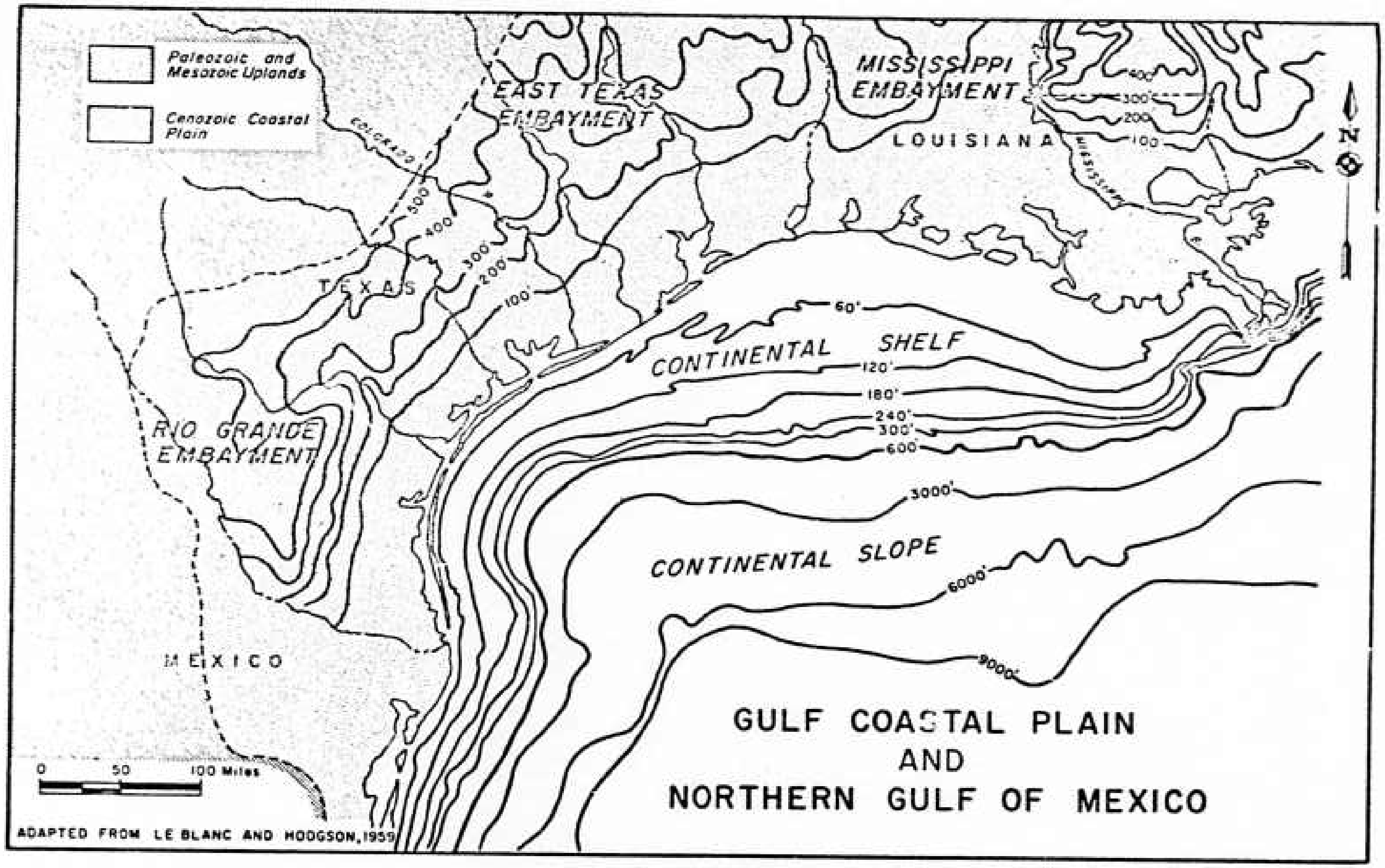
Paleozoic and Mesozoic Uplands
Cenozoic Coastal Plain
EAST TEXAS EMBAYMENT
MISSISSIPPI EMBAYMENT
LOUISIANA
MISSISSIPPI
COLORADO
TEXAS
RIO GRANDE EMBAYMENT
MEXICO
500
400
300
200
100
60'
120'
180'
240'
300'
600'
3000'
6000'
9000'
CONTINENTAL SHELF
CONTINENTAL SLOPE
N
0 50 100 Miles
ADAPTED FROM LE BLANC AND HODGSON, 1959
GULF COASTAL PLAIN
AND
NORTHERN GULF OF MEXICO

Figure 5

The Gulf Coastal Plain ranges in width from about 150 miles to about 300 miles. The width of the bordering continental shelf ranges from about 60 miles (opposite the Rio Grande Embayment) to about 150 miles (southward from the mouth of the Sabine River).

General Cenozoic History

As suggested by Meyerhoff and others (1968, p. 377), apparently five basic geological factors have affected the development of the Gulf Coast geosyncline since its beginning in Late Triassic time: (1) The structural grain of the Paleozoic Ouachita orogenic belt which borders the north and northwest sides of the Gulf coastal plain. The lines of structural weakness inherited from this tectonic belt almost certainly controlled the geometric configuration of the Gulf Coast geosyncline. (2) A depression (the Gulf of Mexico) already existed and, therefore, was conducive to geosynclinal development. (3) Subsidence generally kept pace with deposition in the geosyncline. (4) A thick salt sequence of Late Triassic to Middle Jurassic age provided an important element of structural mobility to the geosyncline. (5) Beginning in Paleocene time, the rising Rocky Mountains (Laramide Orogeny) supplied a high volume of sediments to the Gulf. Much of the Northern American continent was elevated; and throughout the Tertiary and Quaternary, sediments from these land areas were brought to the Gulf Basin. Most of the sediments

deposited in the northern and western Gulf regions during the Cenozoic were terrigenous clastic sediments; carbonates are relatively scarce.

The sedimentation rate within the Gulf coastal geosyncline increased steadily from Triassic time to the present (Meyerhoff, and others, 1968, p. 376). Since the Jurassic, the depositional axis has prograded progressively gulfward. Concurrently with gulfward migration of the geosynclinal axis, the locus of maximum deposition (depocenter), since Paleocene time, has migrated from south Texas, northeastward to southeast Louisiana (fig. 8, Meyerhoff, 1968, p. 386). The maximum thicknesses of Cenozoic stratigraphic units are on the downthrown sides (generally gulfward sides being downthrown) of growth faults. These interesting and important normal faults, characteristic of the Gulf Coast geosyncline, allowed great thicknesses of sediments to accumulate in local depocenters.

Growth Faults

Most stratigraphic units within the Gulf Coast geosyncline increase in thickness toward the Gulf. Importantly, much of the gulfward thickening of the stratigraphic sequences takes place across <u>growth faults</u> (Meyerhoff, and others, 1968, p. 387). Ocamb (1961, p. 139) defines growth faults as "those (normal) faults which have a substantial increase in throw with depth and across which, from the upthrown to the downthrown block, there

is a great thickening of correlative section." Growth faults, being contemporaneous with deposition, are also called <u>syndepositional</u> <u>faults</u>. Characteristics of growth faults as seen in cross section are illustrated in figure 6 (taken from Murray, 1961). Throws of several thousand feet are common. Growth faults commonly form arcuate patterns and are generally both downthrown and concave toward the Gulf. Fault alignment is usually subparallel to basin margins. Individual faults may extend for several to tens of miles (fig. 7 from Jones, 1969, figure 2); bifurcation of faults may also be present.

Growth faulting, although its cause is not well known, may likely be initiated under conditions of greatly increased overburden pressure, as for example with the influx of large quantities of terrigenous clastics. Major clastic depocenters are consequently developed on the downthrown sides of these faults. With cessation of downward fault motion, depocenters shift with a new cycle of growth faulting, subsidence, and sedimentary infilling beginning elsewhere, generally farther gulfward (Meyerhoff and others, 1968, p. 389). Sedimentologically, growth faults are most commonly related with the inner- and middle-neritic facies of each stratigraphic unit in the Gulf Coast geosyncline, but they are also formed in outer-neritic, bathyal, and littoral-continental environments.

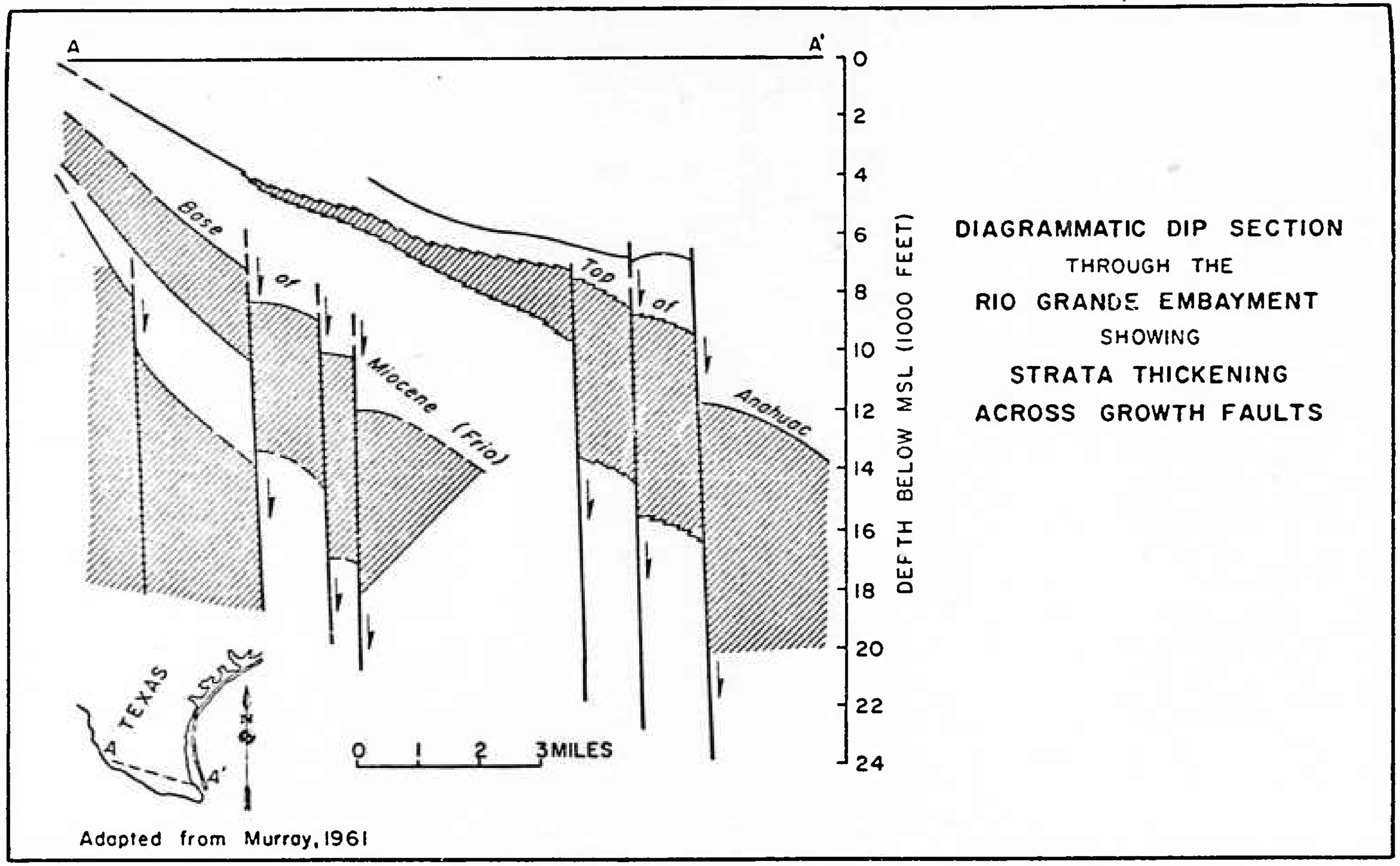
A
A'
DEPTH BELOW MSL (1000 FEET)
0
2
4
6
8
10
12
14
16
18
20
22
24
Base of Miocene (Frio)
Top of Anahuac
TEXAS
A
A'
N
0 1 2 3MILES
Adapted from Murray, 1961
DIAGRAMMATIC DIP SECTION
THROUGH THE
RIO GRANDE EMBAYMENT
SHOWING
STRATA THICKENING
ACROSS GROWTH FAULTS

Figure 6

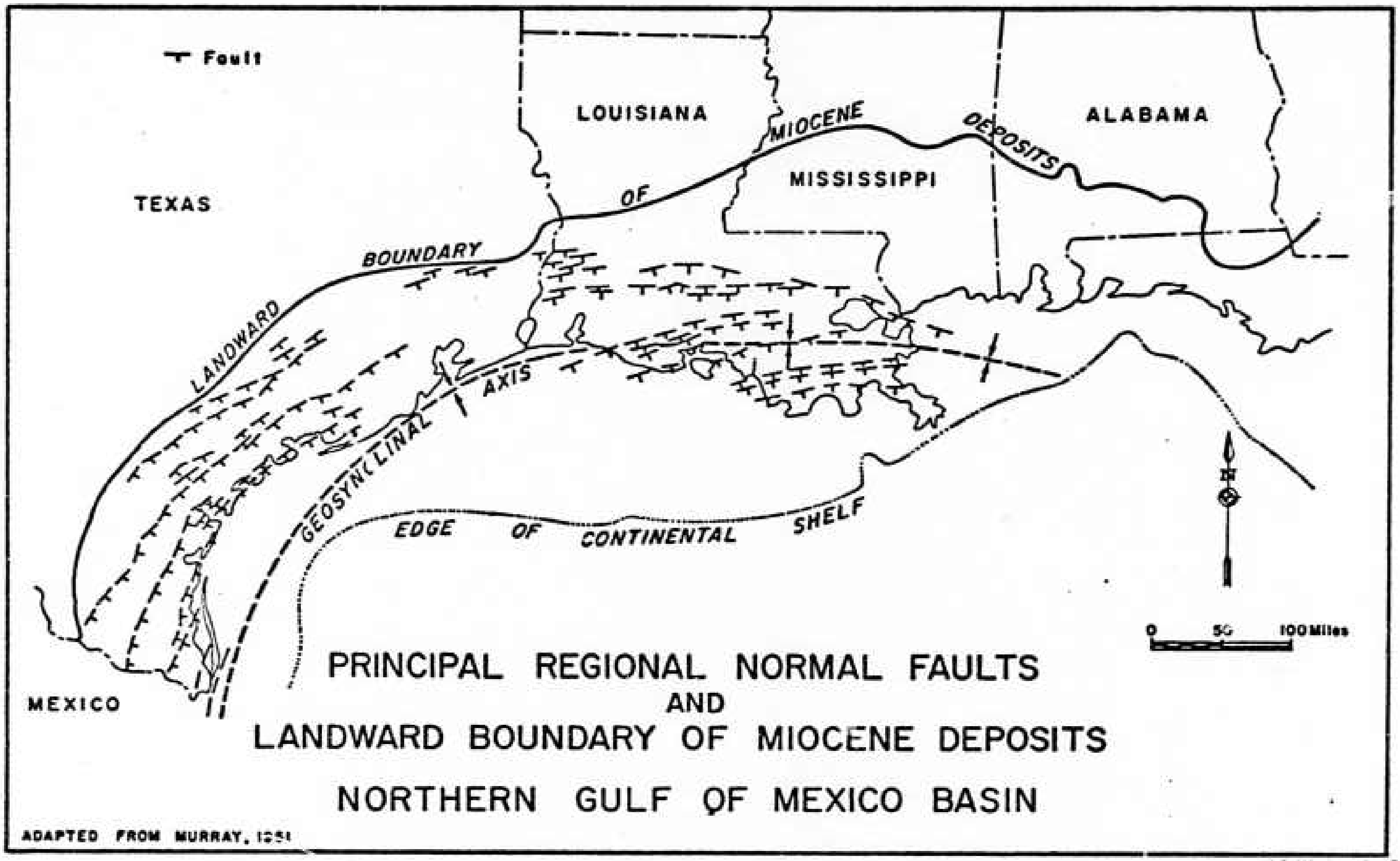
Fault
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
MEXICO
LANDWARD BOUNDARY OF MIOCENE DEPOSITS
GEOSYNCLINAL AXIS
EDGE OF CONTINENTAL SHELF
0 50 100 Miles
PRINCIPAL REGIONAL NORMAL FAULTS
AND
LANDWARD BOUNDARY OF MIOCENE DEPOSITS
NORTHERN GULF OF MEXICO BASIN
ADAPTED FROM MURRAY, 1961

Figure 7

Summary: Cenozoic History, Growth Faults

Drawing from Russell (1940), Fisk and McFarlan (1955), Rainwater (1967), Murray (1961), and Meyerhoff (1967, 1968), the consensus is that during Cenozoic time, the Rocky Mountain area for the first time became the major source of sediments for the Gulf Coast geosyncline. The Paleocene Midway Group represents the most widespread Cenozoic marine unit. Following deposition of the Midway, the sedimentation rate increased rapidly. The dominant centers of clastic input were coincident with the sites of major delta complexes (see Fisher and McGowen, 1967) in the geosyncline. Deltaic and other nearshore nonmarine and/or marine sediments grade gulfward and downward into middle and outer marine sediments. As the rates of sedimentation exceeded the rate of structural downwarping (via growth faulting) beneath these clastic depocenters, the centers would migrate.

Between Paleocene and Quaternary time, the geosynclinal depocenter in the Northern Gulf shifted gradually from south Texas northeastward to south Louisiana. Accompanying this was the gulfward migration of the geosynclinal axis. For example, the Eocene depocenter is in south Texas; the early Oligocene depocenter is in southeastern Texas; Frio depocenters are in southeastern Texas and southwest Louisiana; the Anahuac and early Miocene depocenters

are in southwestern Louisiana; middle Miocene depocenters are in south central Louisiana; and subsequent depocenters are in southeast Louisiana (present Mississippi Delta area). Except during relatively short periods of time, the strand line retreated southward with basin filling. And significantly, the locus of maximum growth faulting accompanied both the gradual shift in depocenter from south Texas to south Louisiana and the gulfward migration of the geosynclinal axis. Thus, due to this offsetting or "leapfrogging" of younger delta complexes over older ones, the thickest stratigraphic section in the geosyncline does not represent the aggregate thickness of sediments that actually were deposited (Meyerhoff and others, 1968).

Salt Domes

Hundreds of salt domes are either known or are believed to exist in the Gulf of Mexico Basin. These are recognized both onshore and offshore in the continental shelf and slope regions of the northern Gulf, (Murray, 1966). Even more recently, salt was discovered in submarine knolls in deep water of the southwestern Gulf of Mexico on Legs I and X of the Deep Sea Drilling Project.

Murray summarizes well the current thinking concerning salt structures in the Gulf of Mexico (Murray, 1966). He states (p. 472-473) that (1) the salt was derived from a thick

mother bed (or beds) of sedimentary salt; the probable age of the salt is Late Triassic-Middle Jurassic. (2) In response to gravitational inequilibrium, the salt moved upward in the form of diapiric structures, via plastic deformation, through the overlying sediments. (3) Density differences between the salt diapir and the heavier overlying sediments are sufficient to cause relative upward growth through great thicknesses of sedimentary rocks (in the order of thousands of feet).

An alternate theory (Murray, 1966, p. 473) suggests that salt structures may remain at an essentially constant level while the surrounding sediments or sedimentary rocks moved downward around them as deposition increased. Regardless of the origin of the salt diapirs, it is a fact that they are concentrated in areas of greater than normal sedimentary thickness; their times of growth appear to be genetically related to periods of abnormally great sediment accumulation. Salt movements may also be responsible for the formation of growth faults (Meyerhoff and others, 1968, p. 554).

Stratigraphy of Geopressured Stratigraphic Units

The proposed site for the pilot geothermal well is located on the north side of and immediately adjacent to the Rio Grande Embayment. Neogene deltaic and neritic marine deposits in this area form regional aquifer systems with abnormal pore pressures, salinities, and water temperatures. These sediments consist of rapidly buried terrigenous sand and clay

sequences, generally sealed off by growth faults and lithofacies changes, and remain undercompacted; abnormally high fluid pressures (up to 0.96 times the overburden pressure) are common in these aquifers (Jones, 1969).

The Catahoula Group, and more specifically, the Frio Formation, contains these geopressured aquifers in the study area. This group is considered to be Miocene in age by Holcomb (1964) and is so considered in this report (fig. 6 of Jones, 1969). Jones (1969) gives an excellent review of the Frio and adjacent units and their hydrologic significance. The Frio Formation is a thick sand body, exceeding 3000 feet in thickness locally, and contains no important clay interbeds. It underlies the south Texas Coastal Plain and extends 150 miles parallel to the Gulf shoreline (fig. 7 of Jones, 1969). Boyd and Dyer (1964) interpret the buried Frio sand body as a former beach or offshore bar. To quote from Jones (1969, p. 11), the Frio "consists of coarse to fine-grained, well sorted, porous quartzose sand that grades updip into lagoonal shale and downdip into inner neritic marine shale. The main body, which ranges in width from 25 miles in Aransas, Calhoun, and Refugio Counties, Texas, to 40 miles in Nueces County, Texas, was apparently formed by longshore currents which transported sand northward from an ancestral Rio Grande delta that was being reworked by wave action."

In the northern Gulf Basin the Frio is the best-mapped geologic formation above the Vicksburg Formation (fig. 6 of Jones, 1969). In a segment of the regional structure map (fig. 13 of Jones, 1969) he shows the top of the Frio Formation along the Texas coast between Latitudes 27°30' and 29°00'. Quoting again from Jones (1969, p. 24-26): "The nearly uniform shape of the Vicksburg flexure (top northwest of Fig. 13 of Jones, 1969) contrasts sharply with the domed, faulted, and folded conditions to the southeast. The heavy dashed double line that crosses Nueces and Kleberg Counties in the southwestern corner of the map shows the coastward alignment of section A-A' in Figure 14. This section shows the subsurface conditions in a part of the Gulf Basin outside of, but immediately adjacent to, the Rio Grande Embayment. The large throw of the major fault, which displaces the Vicksburg Formation 2000 feet between wells 3 and 4 at a depth of 6,600 feet, becomes less at shallower depths; two small faults, with a total displacement of about 200 feet, are shown between 2,400 and 2,700 feet. No other fault occurs northwest along this section updip from the Vicksburg flexure."

The individual displacements of the seven known faults between the Vicksburg flexure and the Gulf shoreline are less than 500 feet; the cumulative displacement is less than 2,000 feet. In general, above a depth of 6,000 feet, individual throws

do not exceed the thickness of the sand zones that form regional aquifer systems. This fact is important in aquifer salinity distribution.

Below 6,000 feet, gulfward from the Vicksburg flexure, Frio barrier-bar sands appear (Jones, 1969, fig. 7); landward from the flexure, the areal continuity of sand beds is very poor, even without the effects of faulting.

Another geologic section, (Jones, 1969, fig. 15) follows approximately the axis of the Rio Grande Embayment from eastern Hidalgo County to the Gulf. A thick sand bed, situated between depths of 12,300 feet and 14,400 feet in well 1, is probably the basal unit of the Frio--if the cumulative thickness of the Oligocene and younger deposits here exceeds 16,000 feet, as indicated by Rainwater (1967, figs. 18 and 20). The displacement of the top of the Frio Formation along regional normal faults is relatively minor landward from well 8 (in northwestern Cameron County). Southeastward, a gulfward downthrow of 1,700 feet is evident between wells 8 and 9. A displacement greater than 3,000 feet, with a gulfward downthrow, is shown about 6 miles out from well 10.

Very rapid thickening of the Anahuac Formation and the younger Miocene deposits (indicated by the resistivities in wells 11, 12 and 13 and the dip section in Jones' fig. 11)

has occurred along the Gulf shoreline, with thick sand sequences separated by very thick clay. The areal continuity of individual beds is good within fault blocks, but fault zones have severed most sand beds completely.

SUBSURFACE EVALUATION OF THE TEST AREAS

Survey maps showing the location and total depth of every oil well in the vicinities of the Sebastian, Port Mansfield, and Corpus Christi sites were obtained from Tobin Aerial Surveys. Electric logs from all wells with depth greater than 10,000 feet were visually analyzed, and aquifers were picked using the spontaneous potential and resistivity curves. Information such as depth, thickness, bottom hole temperature, spontaneous potential, mud weight and type, and identification for each aquifer was punched on computer cards. A salinity computation procedure developed by the USGS (R. Wallace and P. Jones, personal communication) was programmed and, along with routines to calculate the corrected aquifer temperature and the formation pressure, was used to process the punched data. From these results, wells containing high-temperature, high-pressure, low-salinity aquifers were easily recognized. Porosity and permeability values for these prospects were obtained from core sample information (Johnson and Mathy, 1957). Structural control on the aquifer-bearing Frio formation was furnished by the USGS (Jones, personal communication). This information was used to delineate the particular growth fault blocks containing the better aquifers and to estimate the aquifer volume.

On the basis of the above analysis, the Corpus Christi area was eliminated from consideration. There are no aquifers in this area below a depth of about 10,000 feet. The Frio sands, occurring at 7000-10,000 feet have salinities of 50,000-100,000 ppm, and their temperatures are not as high as at comparable depths in areas to the south.

The Sebastian site appears to be an excellent prospect. The pertinent subsurface data is listed in Table 1. These data were obtained primarily from a 15,000-foot well (C-2, Appendix 2) located less than a mile from the geographically-ecologically optimum site described in the environmental section. Another well (H555, Appendix 2) located 10 miles away, but in the same fault block, shows similar low-salinity, high-pressure conditions, and indicates that the over-pressured aquifer system likely extends throughout the block.

The subsurface data pertaining to the area between Port Mansfield and Raymondville is listed in Table 2.

There is a group of sands at a depth of 12,650 feet with a temperature of about 267° F and a formation pressure of 10,000 psi. Salinity is about 20,000 ppm. At a depth of 15,660 ft., an 800 foot series of sands occur with pressure and temperature conditions similar to Sebastian but the fluid salinity appears

TABLE 1

Sebastian Site

Approximate depth to geopressured aquifers	14,300 ft.
Thickness of aquifer series	700 ft.
Corrected temperature (°F)	320-325
Pressure (PSI)	11,600
Salinity (PPM)	2000-6000
Areal extent of faulted block containing aquifers	10 miles by at least 30 miles
Existence of evidence that low-salinity geopressured conditions exist elsewhere in block	Yes (H555)
Porosity of aquifers	20%
Permeability of aquifers	100-135 millidarcys

TABLE 2

Port Mansfield Site

Approximate depth to geopressured aquifers	12,650-15,660 ft.
Thickness of aquifer series	800 ft.
Corrected temperature (^{o}F)	267-329
Pressure (PSI)	10,000-14,381
Salinity (PPM)	20,000
Areal extent of faulted block containing aquifers	About same as San Sebastian
Existence of evidence that low-salinity geopressured conditions exist elsewhere in block	Yes (C-177)
Porosity of aquifers	20%
Permeability of aquifers	100-135 millidarcys

to be 3-4 times greater (i.e., about 20,000 ppm). The data in Table 2 were taken primarily from a 16,122 foot well (W-73, Appendix 2). This is the well closest to the site (26^{o} 29' 00"N, 97^{o} 30' 45"E) which penetrates the geopressured zone; however, it is about 15 miles to the west. Wells with total depth of 10,000-13,000 feet (W-2, W-3, W-5) which are much closer to the site do not appear to penetrate the geopressured zone.

ENVIRONMENTAL INFORMATION
SEBASTIAN SITE

Location

The Sebastian site is on a tract of land located in the Lower Rio Grande Valley of Texas in the extreme north-western corner of Cameron County, at approximately 26° 19' N and 97° 50' E. The site, which is presently being used for dryland cotton production, is immediately to the north of the northern levee of the North Floodway of the Rio Grande River. It is approximately a half to one mile west of the 200 acre Langoria Unit of the Las Palomas Wildlife Management Area. The nearest large market center is Harlingen (population $\sim$ 41,000) fourteen miles to the south-east via excellent, paved roads. Several small communities, of which Sebastian (population $\sim$ 1000) three miles to the north-east and Santa Rosa (population $\sim$ 1,500) four miles to the south are the nearest, are situated within a radius of five miles and are accessible by bituminously surfaced state highways. The site is about 24 miles west of the northern end of the Laguna Atacosa National Wildlife Refuge.

Climate

The region has a warm dry subtropical climate. The annual mean monthly temperature is 73.7°F with highest and lowest monthly

means occurring in August and January with 84.1^{o}F and 61.4^{o}F, respectively. Usually there are about 2 days per year with below freezing temperatures.

The region has a mean annual rainfall of $\sim$24" but there is a net deficiency of precipitation of about 24" due to high potential-evaporation rates. September is usually the wettest month with 4.99" of rain while March is the driest with an average of 1.04". Snow is extremely rare.

There is a 95% probability that within any one year > 15" of rain will fall but only a 10% probability of > 35". The maximum 24 hour rainfalls for 100 and 10 year periods are 11" and 7", respectively. The 100-year one-hour rainfall maximum is 4.5". The mean noon relative humidity is greatest in January ($\sim$ 65%) and least during July and August ($\sim$ 50%).

At an elevation of 30 feet above ground level the 50 year wind speed maximum is 80 mph, and a wind speed of about 50 mph may be expected at least once every two years. Along a 50 mile stretch of coast including Willacy and Cameron Counties there is an 8% probability of a hurricane and a 2% probability of a "great" hurricane (winds speeds > 125 mph) occurring in any given year.

General Stratigraphy and Structure

The Lower Rio Grande Valley area is underlain by deposits of silt, sand, gravel and clay ranging in age from early Tertiary to

Holocene. The formations have a regional dip to the east towards the Gulf of Mexico. Except for the Recent deposits, the angle of dip of the top of each formation is greater than the slope of the land surface; consequently, the formations outcrop in northward-trending belts in which the youngest unit is on the east and the oldest in the west. The deposits tend to thicken downdip and the older formations have greater dips than the younger deposits.

In addition to the structural movement resulting in the eastward regional dip of the formations, some faulting and folding has occurred. The resulting structures have an important control over the occurrence of oil and gas and have been identified largely in the depth zones in which oil and gas occur. The folds and faults are less apparent at shallow depths, in part because of the difficulty of distinguishing and correlating younger stratigraphic units.

The subsurface materials of the eastern part of the Lower Rio Grande area are largely flood plain and deltaic deposits, which consist of complexly interbedded layers and lenses of clay, silt, sand and gravel. Changes in the character of the material occur in short distances both vertically and laterally, and stratigraphic units cannot be correlated over the area.

Maps showing the geology of the Lower Rio Grande Valley area have been published by Bailey (1926), Trowbridge (1932), Darton et al, (1937), and Weeks (1937 and 1945). However the location of the geologic units do not agree on any two of the maps.

Topography

The site is situated on the broad flat surface of the Rio Grande Delta. It has an average elevation of 45 feet with minor ridges and closed depressions, which usually do not exceed 5 to 10 feet of relief.

Surficial Geology and Geomorphology

The area is located on Pleistocene age coastal deltaic deposits of the Beaumont Formation. This formation is comprised of gray and tan colored clays, sand and sandy clays with a few calcareous nodules. The site is situated near to the boundary between the Oberlin and Eunice aged deltaic coastal plains which Price (1958) distinguishes on the basis of surface gradients. The Oberlin surface which lies to the west has a gulfward gradient of about 3 feet per mile whereas the Eunice surface has a gulfward slop of about 2 feet per mile. Both surfaces have at some time been covered by a veneer of aeolian sand. In the vicinity of the site the broad shallow depression and associated low ridges are attributed to deflation and deposition.

Several miles to the west of the site the Oberlin surface is interrrupted by Mercedes-Raymondville floodplain deposits, which are post-Eunice age. These are interpreted by Price to have been deposited in a short-lived distributary of the Rio Grande, which was formed when an independent consequent delta stream captured the river for a time.

Soil

The Sebastian site is located in an area where the predominant soil type is a dark grayish to dark-brown fine sand or fine sandy loam to a depth of 10 to 15 inches. The subsoil is a yellowish-brown fine sandy clay extending to a depth of 36 inches or more. The lower subsoil is slightly lighter in color than the upper portion, which may be partly due to an abundance of lime accumulations. Soft lime concentrations are abundant throughout the subsoil and increase with depth. When set, the soil frequently has an almost black appearance. Immediately beneath the plow depth the soil is rather compact in some places.

The Victoria fine sandy loam is considered locally as the best citrus fruit soil in the county. Cotton is the major crop grown in the vicinity. This soil is thought to be the best

producer among the regional soils in dry weather.

Vegetation and Wildlife

The Sebastian site is part of a large, old ranch which has been divided and sub-divided among heirs. The project area is entirely under dry-land cotton cultivation and none of the former native brush can be found on it. However, adjacent to the site there is a tract of virgin brush, which is a remnant of a former very extensive native chaparral cover of the Lower Rio Grande area. This brushland was incorporated into the 200.53 acre Langoria Unit of the Las Palomas Wildlife Management Area in 1957-1958 and is now under the supervision of the Texas Parks and Wildlife Department.

The brush in the Langoria Unit is dominated by a canopy of mesquite (Prosopis chilensis) which is a favored habitat of the white-winged dove (Zenaida asiatica). The understorey is comprised of such native species as desert hackberry (Celtis pallida), bluewood condalia (Condalia obovata), ebony (Pithecolobium flexicaule) and others which are listed in Appendix 3.

This area of residual chaparral is an important nesting and roosting area for several native Texas birds. Perhaps the most important from the point of view of wildlife management is the white-tailed dove. Until the clearing of the brush this

bird enjoyed a much denser and wider distribution along the Lower Rio Grande and today seventy percent of a much reduced population nests, roosts and feeds on the Tamaulipas side of the Rio Grande boundary. The Texas Parks and Wildlife Department is presently experimenting with planting large grainfields on the non-brush part of the Langoria Unit with the hope that a plentiful food supply close to the chaparral thickets will entice a greater number of the doves to stay in Texas.

Other common avian species using the Langoria Unit are the great-tailed grackle (Cassidix mexicanus), mourning dove (Zenaidura macroura), bronze cowbird (Tegavious aeneus) and others listed in Appendix 4. In recent years the Texas Parks and Wildlife Department has made concerted efforts to introduce the chachalaca (Ortalis vetula) to the Langoria Unit.

Three miles north of the Langoria Unit in south-west Willacy County there is a second Las Palomas Wildlife Management Area named the Frederick brush tract. It contains approximately 45 acres of chaparral with grasses and forbs restricted to fringe areas. The overstorey is predominantly mesquite - bluewood condolia association, with desert hackberry dominating the understorey. The brush tract presently supports twenty to thirty pairs of white-winged doves per acre. It is also well used by nesting mourning doves and has a small population of

chachalaca.

Ground water hydrology

Two sources of ground water suitable for irrigation, public supply, or industrial use have been recognized in the vicinity of the site: the Lower Rio Grande ground-water reservoir and the Mercedes-Sebastian shallow ground-water reservoir.

The Texas part of the Lower Rio Grande ground-water reservoir is in southeastern Starr, southern Hidalgo, western Cameron and a small part of southwestern Willacy counties. The lateral limits of the reservoir in Texas encompass an area of about 1,150 square miles, of which about 950 square miles is productive. The ground-water reservoir consists of beds of water bearing material in the Goliad, Lissie and Beaumont Formations and also post-Beaumont alluvium. The permeable beds are hydraulically connected so that they behave as a unit; however, locally they are separated by beds of less permeable material. The general limits of the Lower Rio Grande ground-water reservoir in a northeasterly and easterly direction are marked by the limits of water suitability for irrigation and industrial use. In southeastern Hidalgo County and western Cameron County, the shallow deposits are usually treated as a separate reservoir on the basis of the chemical quality of the ground-water, discussed later as the Mercedes-Sebastian shallow ground-water reservoir.

The maximum thickness of the lower Rio Grande ground-water reservoir is about 700 feet; however, the thickness is irregular and generally less than 500 feet. The dissolved-solids content of the water tends to increase with depth so that for most uses an effective lower limit to the reservoir can be defined on the basis of the chemical quality of the water. In general, water of the best quality in the lower Rio Grande ground-water reservoir is near the Rio Grande and the water tends to be of increasingly poorer quality going north from the river.

Water in the upper part of the lower Rio Grande ground-water reservoir generally is under water-table conditions. However, as the water moves downward and laterally it may pass under beds of relatively less permeable material so that locally it is under artesian conditions. This is true, for example, in the Harlingen area.

Apparently most of the recharge into the lower Rio Grande ground-water reservoir is by the downward percolation of water from the land surface. The amount of recharge fluctuates with differences in precipitation, being largest during periods of above normal rainfall. Prior to the development by man most discharge from the reservoir was by evapotranspiration. The rate of discharge by evapotranspiration was reduced as land was cleared for cultivation. During periods of high precipitation,

such as accompany hurricane storms in the area, the reservoir may be filled to near capacity so that water logging of the soil occurs. The amount of water available in storage is not large compared to the total potential capacity of the wells. During protracted periods of below normal rainfall, when the rate of pumping is at a maximum and the rate of recharge is at a minimum, the water available in storage could be depleted in a relatively short time.

A number of wells in the area peripheral to the Sebastian site were drilled into the Rio Grande ground-water reservoir to depths of 300 to 400 feet. Seven of the wells within a radius of one mile from the site used the water for irrigation on land holdings of 50 to 300 acres. These wells are known to have operated throughout the 1950's. During this period records show that the water level in the wells declined during the initial years but increased rapidly between 1957-1959 and in many places was within 5 feet of the surface. The total dissolved solids content of the water was between 3 and 4% and was alkali with a sodium absorption ratio of between 25 and 35. The U.S. Department of Agriculture would classify this water as very high salinity water which is not suitable for irrigation under ordinary conditions and as a very high alkali hazard.

The boron content ranged from .002 to .008%. A boron content greater than .00375% in irrigation water is thought to be unsuitable for tolerant crops (Scofield, 1936).

Water from the Mercedes-Sebastian shallow ground-water reservoir contains considerably less dissolved solids than the underlying Rio Grande reservoir. It consists of permeable deposits, less than 100 feet below the land surface, of the Mercedes-Raymondville distributary floodplain and flanking Beaumont Formation. The reservoir extends through southeastern Hidalgo, western Cameron and southwestern Willacy counties but its lateral extent is poorly defined and is best delimited on the basis of the quality of the water from the wells tapping it.

The water from shallow wells near the Sebastian site is noticeably less saline than that from the deeper wells and the data suggests that the site is located near the source of some of the freshest water in the Mercedes-Sebastian shallow ground-water reservoir. The U.S. Department of Agriculture (U.S. Salinity Laboratory Staff, 1954) would classify most of the shallow ground water reservoir as very high salinity water which is not suitable for irrigation under ordinary conditions; the area immediate to the site would be classified as high salinity water which cannot be used on soils with restricted drainage.

The sodium absorption ratio (s a r) is low in the vicinity of the site and is indicative of a low alkali hazard. The dissolved nitrate concentration is the highest for the reservoir and may indicate bacterial contamination.

The yield of individual wells tapping the Mercedes-Sebastian shallow ground-water reservoir is small and is used for public supply, domestic, irrigation and stock use. In the area of the site none of the Mercedes-Sebastian shallow ground-water is used for irrigation.

Land Use

The site of the proposed power plant is presently under dry-land cotton acreage. This is a land use for which the soil is well suited and a good yield per acre can be obtained without using irrigation water. At a distance of approximately 5/10 to 6/10 of a mile east of the proposed site the land use changes to that of wild life management of the Langoria Unit.

The site of the proposed cooling pond is a depression that abuts the northern levee of the floodway. This depression has not been cultivated because of poor drainage conditions and is presently vegetated by native grass and shrub.

The Northern floodway has a width of approximately 1/2 mile and artificial levees that are about 10 feet above the surrounding land. A pilot channel centrally located between the two levees

has been dredged to carry local runoff from the surrounding fields. This pilot channel has a capacity of 1,200 to 1,500 c.f.s. The floodway is designed to carry excess water from the Rio Grande to prevent flooding of the river channel in the delta. Entrance to the floodways is provided by two levee openings immediately above and below the Anzaldus Dam. The floodway is designed to pass a peak flow of 75,000 c.f.s. However, a constriction in the floodway where the Willacy Canal Siphon crosses it, some 3/4 mile down the floodway from the site of the proposed cooling pond, would locally reduce this figure.

Prior to building floodways, the United States Government acquired levee and floodway easements at the expense of the counties through which the floodways pass. These instruments permit borrowing of material for construction as well as use of land for carrying flood and drainage water. In effect, floodways are in private ownership to be used as prescribed by the United States Government.

Except in the immediate vicinity of the Willacy Canal Siphon, floodway owners are cultivating acreage within the floodway, but in compliance with the easement regulations. In the area of the site much of this acreage is under cotton production. Several factors contribute to the intense use of

floodway land. Although flood risk will always exist, the probability of flooding decreases as reservoir capacity increases upstream. Furthermore, floodways are among the best drained agricultural land in the Texas delta, as they provide the only drainage channel at a distance from the Rio Grande. New structures may be erected only by permission of the International Water and Boundary Commission, and must be portable and less than 225 square feet in surface area.

Other land uses in the neighboring area include two cemetaries, El Azadan, 3/4 mile to the east of the proposed cooling pond, and Santa Rita, 1 mile to the north of the site of the proposed power plant. Both may date back to the era of Mexican sheepherding before the division of the Santa Rosa Ranch. South of the floodway there is a network of irrigation and drainage ditches and the land between the floodway and the town of Santa Rosa is irrigated farmland, with a sparsely scattered population. To the north of the site of the proposed power plant local wells supply water to small localized irrigation projects.

At a greater distance but within a radius of 10 miles there are several small population centers dependent upon local agriculture for their existence. Seven miles to the southwest is the Lacy Mercedes oilfield which is of very limited extent.

Population and economics of labor force

In 1970 Cameron County had a population of ~ 140,400 people, which is a net decrease of 7.1% from the 1960 census. Twenty-two and a half per cent of the population were classified as rural - 18.5 rural non-farm and 4.0 rural farm. The median value for school years completed was 8.5. There was a high non-worker/worker ratio (2.20) and a 6.6% unemployment rate. The median income was $5,068 and 38.5% of the population was below poverty level. Of those employed 11.4% were in manufacturing, 43.2% white collar workers, and 17.3% were associated with government services.

Harlingen, the nearest sizeable urban area to the Sebastian site is situated at the intersection of the lower Rio Grande Valley's two main highways and two major railroads. It is the distribution center for a large irrigated hinterland and handles supplies of citrus fruits, vegetables and cotton. In 1970 Harlingen contained ~ 33,500 people, a net decrease of 18.7% from the 1960 population. The non-worker/worker ratio is 1.96 and the unemployment rate 5.6%. Of those employed 10.9% are in manufacturing, 48.1% white collar and 15.5% are government workers. The median income was $5,875 and 32.3% of the population's income was less than poverty level.

Edcouch, 7 miles west-south-west of the site in eastern Hidalgo County, is typical of small urban communities scattered throughout the region. It is situated at the junction of two railroads from where it is an export center for local agricultural produce; cotton, citrus and vegetables. In 1970 Edcouch had a population of 2,656, a net decrease from the preceeding census of 5.6%. The median school years completed for the community was 5.7, the non-worker/worker ratio 2.17 and the unemployment was high at 7.0%. Of those employed 11.3% were in manufacturing; the median income was only $4,461, and 54.9% of the population income was below poverty level.

Other small population centers within a 5 mile radius of the site are Santa Rosa (pop. 1466), La Villa (pop. 1255) and Sebastian (1,000). Santa Rosa, which is 4 miles to the south, has an economy based on cotton, citrus and vegetables which it exports via the Missouri-Pacific railraod.

Environmental Impact

The Environmental Impact Matrix for the Sebastian site is shown in Appendix 5. An inspection of the matrix indicates the possibility of significant impacts in the following areas:

Well blowout. A blowout during drilling of the pilot well would have serious effects on almost every aspect of the environment in the vicinity of the well. However, a great backlog of

experience in drilling into high pressure zones has been developed in recent years and, in fact, high pressure wells have been successfully completed in the immediate vicinity of the pilot site. Using state-of-the-art drilling techniques, the probability of a blowout must be considered minimal.

Effect on aquifers. Using approved oil field techniques of drilling and casing, no contamination of fresh water aquifers should be expected during drilling. Nor should the reinjection of water into aquifers at the 5000-6000 foot level in any way degrade these waters. In fact, the waters at this depth are normally so salty that reinjection will tend to freshen them.

A lined surface holding tank will be constructed near the well site to serve as a retainer for water that might be accidentally spilled during operations. Spilled water will no doubt be very hot and possibly salty. If salty water were allowed to stand in an unlined holding tank for an extended period of time, it could have a contaminating effect on the water table which is very near the surface. However, water would be present in the holding tank only in case of an accidental spill and even then would be retained only long enough for it to cool before it was routed to the North Floodway and then to the Gulf.

Noise. The maximum noise will occur during drilling when a large diesel engine will be in operation. After drilling is

completed, and when proper operation is underway, the only noise will be due to a large turbine. No venting of gases will be necessary; thus, a prime source of noise and a possible source of atmospheric pollution is omitted.

Effect on sea water. The water reaching the North Floodway and the Laguna Madre will have been cooled in the holding tank. Thus, there will be no adverse temperature effect on sea plant and animal life. The salinity of the Laguna Madre varies between 35,000 and 100,000 ppm, so any well water introduced into it will actually be fresher.

Subsurface strain. Withdrawal of water by one well over a period of five years will cause some subsidence. However, the Gulf Coast is an aseismic area, and neither the subsidence nor the reinjection of water should trigger earthquakes.

Land use. The land area composing the Sebastian site is presently under cultivation. Removing the area from cultivation and constructing the pilot project will cause no conflict with existing transportation networks, utilities, residences, or recreational facilities.

ENVIRONMENTAL INFORMATION
PORT MANSFIELD SITE
(TENERIAS AREA)

Location

The Tenerias area is situated in eastern Willacy County approximately 6 to 7 miles inland from the Laguna Madre and is described by the co-ordinates 26° 29' N and 97° 30' 45" E. The site which is located on the El Sauz subdivision of the King Ranch is 4 miles east of the small ranch community of El Sauz. Ten miles to the south-southeast is the northern boundary of the Laguna Atacosa Wildlife Refuge and 3 miles to the southwest lies the Willamar Oil Field.

The site is some half mile south of a bituminous surfaced road (FAS 497) which connects the area to two small communities; San Perlita (pop. 348) which is 8 miles to the west and Port Mansfield (pop. 200) which is 7 miles to the northeast on the coast of the Laguna Madre. Raymondville (pop. 8,000), the largest town in Willacy County, is 16 miles to the west on route FAS 497.

Climate

The region has a warm dry subtropical climate. The annual mean monthly temperature is 73.7° with highest and lowest monthly means occurring in August and January with 84.1° F and 61.4° F.

Usually there are about 2 days per year with below freezing temperatures.

The region has a mean annual rainfall of $\sim$ 24" but there is a net deficiency of precipitation of about 28" due to high potential-evaporation rates. September is usually the wettest month with 4.99" of rain while March is driest with an average of 1.04". Snow is extremely rare.

There is a 95% probability that within any one year > 15" of rain will fall but only a 10% probability of > 35". The maximum 24 hour rainfalls for 100 and 10 year intervals are 11" and 7". The 100-year one-hour rainfall maximum is 4.5". The mean noon relative humidity is greatest in January ($\sim$ 65%) and least during July and August ($\sim$ 50%).

At 30 feet above ground level the 50 year wind speed is 70 mph, and a wind of about 50 mph may be expected every two years. Along a 50 mile stretch of coast including Willacy and Cameron Counties there is an 8% probability that a hurricane and a 2% probability that a "great" hurricane will occur in every year.

<u>General Stratigraphy and Structure</u>

The Tenerias area is underlain by strata of shale, clay, silt, sand and gravel which range in thickness from $\sim$10 to $\sim$100 feet. The sedimentary formations have a regional dip to the east towards the Gulf of Mexico. The angle of dip

of each formation is greater than the slope of the deltaic plain and the formations outcrop in north to south trending belts to the west of the area. The deposits tend to thicken downdip and the older formations have greater dips than the younger deposits.

In addition to the structural movement resulting in the eastward regional dip of the formations some folding and faulting has occurred. Such structures have an important control over the occurrence of oil and gas and are identified mainly in depth zones in which these phenomena occur. The folds and faults are less apparent at shallow depths, in part because of the difficulty of distinguishing and correlating younger stratigraphic data.

Topography

The Tenarius area is situated on the north eastern part of the exposed surface of the Rio Grande coastal deltaic plain. The surface which is of Pleistocene - Eunice - age has a gulfward gradient of approximately 2 feet per mile. It has an average elevation of about 10 feet with minor ridges and depressions which range in elevation between 20 feet above to 5 feet below the surrounding surface.

Surficial Geology

The area is located on the Pleistocene aged deposit of

the Beaumont Formation which is comprised of gray to tan colored clays, silts, sands and sandy clays with some shell strata. The sedimentary material in the Tenerius area was deposited by freshwater in a shallow marine environment and was later reworked by marine and coastal processes. In this process a large amount of sodium chloride and other salts were incorporated into the surficial material.

The area has numerous comparatively narrow old stream channels which extend inland through the deltaic surface. From time to time salty water is forced up these channels and removed chiefly through evaporation, depositing salts in the bases of depressions. The high salt content of the soil in these basins and old channels is responsible for a series of mounds and elongated ridges lying 5 to 20 feet above the surrounding countryside. These mounds and depressions occur on the leeward side of the depressions and basins and are the result of a combination of chemical and aeolian agencies. On drying the salty soil of the basins becomes fluffy and loose, owing to the action of the salt. This soil is readily taken up by the prevailing winds and is deposited on the northwestern side of the depressions. The ridges have typical dune contours, with a steeper slope on the leeward side than on the windward side. Most of the mounds and ridges are symmetrical, though

there are many incipient or immature dunes. The dunes can be comprised of either clay or sand, the latter generally being less saline than the former due to greater post-depositional leaching.

Soils

Two soil types predominate in the Tenerius area, the Victoria fine sandy loam (salty phase) and the Lomalto clay loam. The Victoria fine sandy loam is associated with land over 10 feet above sea level and in this particaular area with the dune formations. The Lomalto clay loam is usually restricted to the land below 10 feet and with depressions and intermittent lake beds.

The surface soil of the Victoria fine sandy loam - salty phase - consists of 10 to 12 inches of dark brown or black friable fine sandy loam which in virgin areas may be covered with brown or slightly dark-brown fine sand or loamy fine sand an inch or more thick. The surface soil is generally calcareous at its lower depth. This topsoil is underlain by dark brown or nearly black friable calcareous fine sandy clay or clay loam which may contain some small soft, whitish lime accretions. Below a depth ranging from 16 to 24 inches is brown, slightly light brown, or light brown friable fine sandy clay or clay loam. This material is usually very calcareous.

Below a depth ranging from 30 to 36 inches is pinkish buff or buff brown friable, highly calcareous, fine sandy clay or clay loam containing large and small aggregates of soft, white, lime material. This material continues to a depth varying from 6 to more than 8 feet.

The salty phase of this soil contains a high content of water soluble salts. The average salt content to a depth of 5 feet ranges from 3 to 4% or more. In the flatter areas, the combination of low surface gradient and heavy subsoil produce a relatively slow rate of water percolation compared to the more typical Victoria fine sandy loams to the west.

The surface soil of Lomalto clay loam may be dark-gray, grayish-brown, or brown clay loam, varying from 8 to 15 inches in thickness. It is underlain by grayish-brown or light brown clay loam or light clay which continues to a depth ranging from 20 to 30 inches, where it is underlain by yellowish-brown, brown, or buff-brown clay which may continue to a depth of more than 5 feet without change but which is commonly mottled or splotched with gray and ocherous yellow. The typical soil is usually calcareous from the surface down. The yellowish-brown, brown or buff-brown layer is highly calcareous and in most places contains soft white lime material. Fragments of snail shells are present to a depth of 2 feet and the surface

and upper part of the soil in some places are thickly strewn with them. Fiddler crabholes and chimneys are common in the lower areas. In the lower part of the soil salt aggregates are common and gypsum crystals are present in some places. When the soil is dry salt crystals may be seen over the surface in many areas.

During wet seasons the soil is saturated and water frequently covers the surface to a depth of several inches for long periods after rainy seasons. Even following long dry periods saline water is reached at a depth of 2 ft. in most places.

Vegetation

The pattern of vegetation in the Tenerius area is closely associated with the two predominant soil types and is clearly distinguishable.

The Victoria fine sandy loam - salty phase - is dominated by a canopy of stunted mesquite (*Prosopis chilensis*) and huisache (*Acacia farnesiana*). Other stunted and sparsely scattered woody species include ebony (*Pithecolobium flexicaule*), blue wood condalia (*Condalia obovata*), retema (*Parkinsonia aculeata*) and prickly pear (*Opuntia spp.*). The dominant grass species are sacahuista grass, a salt loving species, and buffalo grass (*Buchloe dactyloides*) with such species as Bermuda grass

(*Cynondon dactylon*) and needle grass where the salt content is not too high.

The Lomalto clay loam supports a marine - plant association consisting mainly of sacahuista grass, sea orange (*Barrichita frutescens*) and sea purslane (*Sesuvium portulacastrum*). The growth of the sacahuista grass is thicker in places where the salt content is lower; where the salt content is particularly high, the sacahuista grass is dwarfed and scant and other salt loving plants dominate. A few areas in which the soil is so salty as to kill out all vegetation occur in the Tenerius area.

Groundwater hydrology

The groundwater table in the Tenerius area is very close to the land surface. In the lower lying area of the Lomalto clay loam soil, the water table is usually at a depth of less than 2 feet during periods of heavy precipitation and intermittent lakes form in the topographic depressions. The water is very highly saline with a high boron content and a high sodium alkali hazard. The groundwater table is at a slightly greater depth in the area of the Victoria fine sandy loam. The water is too saline for human consumption or for growing crops. Water for rangeland stock is tapped from the Goliad sands - a Pliocene aged formation consisting mainly of clay and sands - at a

depth of 1,300 to 1,600 feet. The total dissolved solids content of this water ranges from 3 - 5000 p.p.m. in the vicinity of San Perlita, several miles to the west, to nearly 10,000 p.p.m. at Port Mansfield. Boron content varies between 6.5 and 11 p.p.m. which even exceeds the limits of boron tolerant crops. The water is classified as having both very high sodium alkali and salinity hazards. However, the water from the Goliad sands is thought to be preferable to the groundwater of the Lissie and Beaumont formations.

Wildlife

The Tenerius area is 10 miles to the northwest of the Laguna Atacosa Wildlife Refuge. The proximity of the two areas, similarity in certain vegetation types and a restricted use of the surrounding land by man means that both areas share a common indigenous and migratory fauna.

This is particularly true of the avian species of which there are very heavy seasonal and, to a lesser extent, annual populations. The lower Texas coast and its immediate hinterland is a major north-south bird migration route and each spring and autumn millions of birds funnel through the area.

The Tenerius area is located near the center of one of the major waterfowl wintering areas in North America. Over 1¼ million ducks and geese winter on the Lower Texas coast and

upper Mexican coast. The Laguna Atacosa Refuge and surrounding area is the major stop-over point for waterfowl going to and from Mexico. From September to March thousands of ducks are on the refuge. In November, when peak use occurs, there are over 1/4 million ducks on the land and adjacent Laguna Madre. The redhead duck (Aythya americana) is the most common, accounting for over 60% of the total duck use. Nearly 80% of the continent's redhead population winters here, feeding on the abundant shoalgrass (Diplanthera wrightii) of the Laguna and utilizing the coastal hinterland. Other common ducks, in order of abundance, are the pintail (Anas acuta), ruddy duck (Oxyura jamaicensis), widgeon (Mareca americana), lesser scaup (Aythya affinis), canvasback (Aythya valisinera), shoveler (Spatula clypeata), blue winged teal (Anas discors), green-winged teal (Anas carolinensis) and gadwall (Anas strepera). Mottled ducks (Anas fulvigula) and black-bellied tree ducks (Dendrocygna autumnalis) nest in the mesquite. Up to 30,000 geese may be on the refuge at the peak of use in November, most of which are Canada geese (Branta canadensis), but snow (Chen hyperborea), blue (Chen caerulescens), and white-fronted geese (Anser albifrons) are also common.

Two endangered species which are on the verge of extinction visit the Laguna Refuge and surrounding land during the winter.

These are the bald eagle (_Haliaeetus leucocephalus_) and the peregrine falcon. A rare species which is a winter visitor to the Laguna Refuge is the prairie falcon which is present in such small numbers throughout its range that it may become endangered if its environment worsens. Nine peripheral Mexican birds, which are rare or endangered within the United States, use the refuge and occur in the United States only in the lower Rio Grande Valley. These are the least grebe (_Podiceps dominicus_), chachalaca groved-billed ani (_Crotophaga sulcirostris_), green jay, Boteri's sparrow (_Aimophila botterii_), all of which are resident or nesting species, as well as the red-billed pidgeon (_Columba flavirostris_), white-fronted dove (_Leptotila verreauxi_), buff-bellied hummingbird (_Amazilia yucatanensis_) and beardless flycatcher (_Camptostoma imberbe_).

In addition to the rare, endangered or peripheral species the refuge is used by 26 other unusual birds which are only found in some of the southern states, eg., the white-tailed hawk which is a year round resident. Many of these nest on the refuge. A total of over 330 species have been recorded and over 80 species nest in the region. A listing of all recorded species is given in the United States Department of the Interior, Fish and Wild Life Service publication entitled "Birds of the

Laguna Atacosa National Wildlife Refuge" (June 1969).

The mesquite and intermittent lakes of the Tenerius area would almost certainly provide a habitat for some of these species since the refuge boundaries do not inhibit the various birds from utilizing the surrounding countryside.

The mesquite and sacahuista grass associations are the habitat for a variety of small amphibians, reptiles and mammals, which are important links in the foodchain of the predator birds. The fulvous harvest mouse (Reithrodontomys fulvescens) form part of the diet of the owls. The white footed mouse (Peromyscus leucopus) is extremely numerous and their role as food for meat eating species is an important factor in the local ecology. Other small ground mammals include the least shrew (Cryptotis parva), the Mexican ground squirrel (Citellus mexicanus) and the Texas pocket gopher (Geomys personatus) which is presently extending its range to the south. Larger mammals which feed on the smaller species are the opossum (Didelphis marsupialis), the hispid cotton rat (Sigmodon hispidus), which is very common and perfers the tall grass as its hunting ground, the longtailed weasel (Mustela frenata), striped skunk (Mephitis mephitis), raccoon (Procyon lotor) and coyote (Canis latrans). Badgers (Taxidea taxus) are rare and ground squirrels (Citellus

mexicanas) are a staple in their diet.

The blacktail jackrabbit (*Lepus californicus*) is not numerous and prefers the grasslands. The eastern cottontail (*Sylvilagus floridanus*) is abundant. In addition there are several species of bat of which the Mexican freetail bat (*Tadarida brasiliensis*), which roosts in large colonies, is the most common in this area.

There are several native cats that have been reported in the area. The bobcat (*Lynx rufus*) is common in the wildlife refuge but the ocelot (*Felis pardalis*) and jaguarundi (*Felis yagouarundi*) are uncommon or rare and probably live only in the refuge where they are protected from man and can hunt in the shelter of dense tropical vegetation and thorny brushlands.

Peccary (*Pecari tajacu*) have increased under the wildlife protection and small bands of these grayish pig-like animals may exist in the Tenerius area. White-tailed deer (*Odocoileus virginianus*) have become more numerous in the wildlife preserve and like the shelter of the mesquite from which they emerge at dusk to feed. It is probable that large numbers also exist on the King Ranch but little is known about the status of the ecology in that area.

Demography

Willacy County is 30 miles east to west and 25 miles from north to south and includes about 625 square miles. Two hundred and twenty-nine of these square miles are under water and another one sixth unfit for cultivation. Parts of the southern and western sections have been cultivated through clearing of native brush but the northern and eastern sections are probably destined to remain ranches.

In 1970 Willacy County had some 15,500 plus people within its boundaries; this represented a 22.5% decrease from the 1960 census figures. Almost half of the population lives in rural areas (37.3% being classified as rural non-farm and 10.0% as rural farm). The population has a below average school educational experience (median value 7.5 school years) and a high non-worker/worker ratio (2.41). Unemployment is high throughout the area and nearly half the people are below poverty level. Of those employed only 2.5% are in manufacturing, 32.6% are white collar and 17.9% in government service. Median income is only $4,156.

Slightly over half of the population live in Raymondville, the county seat. This is the market center for some 150,000 acres of farmland in western and southern Willacy and is a freight station on the Missouri-Pacific railroad. In 1970

this city had a population of about 8,000 which represents a decline of some 14.7% from the 1960 figure. The population has a below average school educational experience (median value 7.5 school years). There is a high non-worker/worker ratio (2.44) and a high unemployment figure (6.4%). Over half the population (51.2%) is below poverty level and the median income is only $3,900. Of those who are employed only 4.2% are in manufacturing.

San Perlita, which is 7 miles west of the Tenerias area has a population of about 300 persons. Little is published concerning the economics of this center but it probably caters to the local irrigation projects and also to some of the ranch needs. The population of this local center has declined by about 25% since the 1950 census was taken.

Land-Use

High salinity and frequent water-logging of the soil has rendered the land completely unsuitable for crop growing. The area has traditionally been used for cattle rangeland.

In recent years this particular part of the El Sauz Ranch has been leased by the Federal Government and is used as a U.S. Naval Research Station for satellite detection.

Several miles to the southwest is the Willamar oil field

which was at peak productivity during the 1940's and early 1950's at which time it ranked sixth among Texas oilfields. Today productivity has declined. East of the Willamar oilfield is the Sauz Ranch - Nopal oilfield. There is no organized community associated with any of the fields and population is sparse.

South of the Sauz Ranch - Nopal oil field is the Laguna Atacosa Wildlife Refuge, which has already been described.

Six or seven miles to the east of the Tenerias area is the Laguna Madre. This inland sea is an important recreational and commercial fishing area. Much of the Texas shrimp industry is located along this coast and the shallow waters are ideal nurseries for the brown shrimp. Port Mansfield, an isolated community on the eastern shore of the Laguna, is the base for a rapidly growing recreational fishing industry. It is a center for both Laguna and Gulf fishing since it has access to the Gulf via the Port Mansfield Pass. The population of Port Mansfield has grown rapidly in the last decade which is a notable exception to the more general trend of rural and small urban population decline throughout Willacy County since the early 1950's.

The physiography and hydrology of the Laguna Madre

The Laguna Madre is a long, narrow coastal lagoon which extends from Corpus Christi Bay southward to the Rio Grande delta.

It is sandwiched between the shore of the mainland and a narrow sand barrier known as Padre Island. The lagoon is shallow, averaging less than 3 feet in depth and in its natural state nowhere deeper than 9 feet. The bottom of the lagoon has a very gentle gradient but is irregular with shallow flats and relatively deeper basins. The width of the lagoon is from three to five miles but varies considerably with small seasonal and meteorologically induced changes in water level. Much of the coastline is inundated intermittently and at times it is difficult to know where the shoreline really is. Midway down the length of the Laguna Madre, south of Baffin Bay, there are extensive mud and sandflats which are submerged only at the highest water levels. This bar effectively divides the lagoon into two separate units as far as marine life and hydrographic conditions are concerned. The northern or upper section of the Laguna Madre will be considered in this section. At the northern end of the Lagoon where it joins Corpus Christi Bay there is a long and shallow transverse bar which effectively cuts off water exchange with the Gulf at all times except at the periods of highest water levels. Normally Corpus Christi Bay is linked with the Laguna Madre only by the Intracoastal Canal and the narrow entrance to the naval boat basin. Several small naturally formed sand islands occur in the Upper Laguna Madre of which the most

noteworthy are North and South Bird Island and Pita Island. Perhaps the most outstanding single feature of the Lagoon is the Intracoastal Canal, a man made ditch 125 feet wide and 12 feet deep. Deposition of sand and mud from the canal has formed a 16 mile long dike in the extreme northern end of the Laguna and allows few passageways for the exchange of water between eastern and western sides of the Laguna. South of the dike numerous islands have been formed by staggering of spoil dumps along each side of the channel. In general the bottom sediments of the Laguna near Padre Island are chiefly sand and those along the mainland sand and clay. Waves are low as a result of limited fetch and shallow depths and the waters are generally turbid. Little of the suspended matter can settle in the shallow areas owing to constant wave agitation. Continuous strong winds, averaging 9-14 mph, especially regular from the southeast quadrant for about seven months of the year cause strong waves throughout most of the day abating only slightly at night. As a result of the predominant southeast winds, waves break mainly on the west and northwest shores and beaches develop only in these areas. The currents follow the winds and are related to wind controlled tides, i.e., when north winds blow, currents flow southward and conversely with southerly winds.

Counter currents have been observed in the deeper water of the Intracoastal Waterway.

There is negligible periodic tide. Rise and fall of water at any particular locality is dependent upon wind condition. Extreme wind can cause a tidal range of 3 to 4 feet. Those meteorological tides are non-periodic and are important controls over water exchanges with the Gulf. Spring and fall celestial tides can raise the water level as much as 18 inches.

The Laguna is a hypersaline body of water. The salinity of the water varies seasonally and annually and from north to south depending on meteorological conditions and runoff and channel discharge from the mainland. Salinity has been known to vary from $\sim$110,000 ppm to $\sim$10,000 ppm but probably averages between 35,000 ppm and 45,000 ppm.

The Laguna is shallow and water temperatures closely parallel the temperature of the air. This means there is considerable daily and seasonal variation. In summer, temperatures between 75°F and 90°F are common in water that is $>$ 2 feet deep and can be $>$ 95°F in the very shallow coastal flats. Daily ranges can be great as 10°F in the deeper water and exceeds this in the very shallow reaches. In winter cold winds known as "northers" can bring near freezing temperatures.

Flora and fauna of the upper Laguna Madre.

In the upper Laguna Madre lower forms of vegetation are not plentiful because of hypersaline water. Phytoplankton are almost non-existent in salinities of 60%. Three species of "grass" (Zosteraceae and Potamogetinaceae) are common to the upper lagoon; of these, widgeongrass (*Ruppia maritima*) and Cuban shoalgrass (*Diplanthera Wrightii*) are abundant and of primary importance to the fauna. High salinity over a period of several months can completely eliminate large areas of widgeongrass and restrict the growth of Cuban shoalgrass.

Members of the phyla Protozoa, Porifera, Platyhelminthes, Nemathelminthes (except planktonic species) and Trochelminthes are all rare in the area, being limited by excessive salinity. Coelenterates are somewhat limited by hypersalinity. Ctenophores are plentiful even at the very highest salinities and provide food for many higher forms. Two euryhaline copepods are present: *Acartia tonsa* is extremely abundant between 47-75% salinity and both types spawn in the area. Several parasitic copepods are present but are limited by salinity above 40%. Two forms of barnacles (Balanidae) are extremely abundant at all levels of salinity but spawn only below 45%. Amphipods are exceedingly numerous throughout the area in salinities of 50% or less and spawn in the area. Three species of penaeid shrimp (Peneidae)

are present but only the brown shrimp (P. aztecus) withstands salinity above 45% and this species does not tolerate salinity much above 60%. Several bivalves are present but gastropods are scarce.

Some of the fauna which live primarily among the grass are: polychaets, amphipods, young penaeid shrimp, palamonid shrimp (Palaemonidae), pistol shrimp (Crangon heterochaelis), crabs (Brachyura), bivalve mollusks, killifish (Cyprinodontidae), pipefish (Syngnathidae), gobies (Bobiidae) and toadfish (Opsanus beta). Most of these species except penaeid shrimps, crabs, pinfish (Logedon rhomboides) and pigfish (Orthopristis ehrysopterus) spawn in the "grasses". Pinfish and sheepshead (Archosargus probatocephalus) feed heavily on the vegetation and black drum (Pogonias cramis) on the bivalves and worms under the roots; the latter is the only marine animal in the area known to be harmful to the vegetation.

A particularly large number of fish species are known in the upper lagoon and some of the most abundant are the pinfish and spot croakers (Leiostomus xanthurus). The shallow flats and vegetation are extremely important nursery grounds for many juvenile species including food and game fishes such as redfish (Sciaenops ocellata), flounder (Paralichthys lethostigma), speckled

trout (Cynoscion nebulosus) sheepshead and blackdrum.

As salinity of the laguna waters increase, the number of species decreases. The number of individuals increase up to an optimum salinity which is usually around 45% and a temperature of 25°C.

Environmental Impact

Inspection of the Environmental Impact Matrix for the Port Mansfield site, shown in Appendix 6, reveals essentially the same areas of impact as were observed for the Sebastian site. The discussions previously given for impacts at Sebastian in the areas of well blowout, effect on aquifers and sea water, noise, subsurface strain, and land use apply also to Port Mansfield.

The only difference between the sites in an environmental sense is that Port Mansfield is located adjacent to a Gulf inlet and contents of the holding tank would be emptied into the inlet rather than into a floodway as is planned at Sebastian. Either situation should cause no environmental disturbances.

Reservoir

Production Calculations

Detailed maps of the geologic structure and sediment distribution in the Texas Gulf Coast indicate that the geopressured region is divided by growth faults and facies changes into water-filled sand units which must be regarded as separate reservoirs. The following calculations are concerned with a model reservoir.

We consider a geopressured zone 1 mile thick, beginning at a depth of 12,000 feet, and consisting of half sand and half shale. The horizontal dimensions are 20 by 30 miles. Essential parameters are as follows:

Bore hole radius..........0.3 ft.
Water viscosity...........0.2 cp
Sand porosity.............0.25
Sand permeability(k)
    Good sands...........0.3 Darcy
    Ave. sand
    (Gulf Coast).........0.05 Darcy

We determine, from the above parameters, that a well drilled into this reservoir should produce 50,000 bbls. (2.1×10^6 gal.) of hot water per day. Calculations have been made to determine the optimum number of wells and the expected cumulative production in gallons for two assumed values of average permeability [1].

1. These calculations were provided by Sidney Kaufman.

Table 3

WATER PRODUCTION
(in gallons)

Number of years	k = 0.3 Darcy 190 wells	k = 0.05 Darcy 35 wells
1	1.5×10^{11}	2.7×10^{10}
2	2.8×10^{11}	5.1×10^{10}
5	6.9×10^{11}	1.2×10^{11}
8	1.1×10^{12}	1.9×10^{11}
10	1.3×10^{12}	2.4×10^{11}
20	2.6×10^{12}	4.7×10^{11}

These calculated production figures do not include the effects from expansion of dissolved gases or from de-watering of overpressured shales, both of which would tend to increase total production. The figures, therefore, are very conservative.

Power production from hot water can be calculated as follows:

Initial Temperature 325° F

Final Temperature 212° F

The temperature drop of 113° F would provide 942 BTU/gal. Converting watts (electrical) and assuming a 10% conversion efficiency, we would require 910 gal./day to produce 1 kilowatt of continuous power. A 50,000 bbl. well would provide 2.5 megawatts (Mw). Neglecting the energy available from water pressure at the surface, we find the power potential for the reservoir to be, depending upon the permeability:

190 wells,	k = 0.3 Darcy,	475 Mw
35 wells,	k = 0.05 Darcy,	88 Mw

Additional power output of about 30% could be obtained by utilizing the energy from the average pressure of the hot water at the well head.

Now we consider the problem of subsidence resulting from a 20 year production history. As a worst case we base the calculations on the maximum rate of production; that is, for k = 0.3 Darcy.

The total volume of water in the reservoir is (at reservoir pressure) 7.5×10^{13} gal With a 0.8 geostatic ratio, the bottom hole pressure is 10,000 psi. Note that the 20-year cumulative production (2.6×10^{12} gal.) is about 3.5% of the total water. We take as the coefficient of elastic expansion for the water 5×10^{-6}/psi and for the pore space collapse ratio 3×10^{-6}/psi giving a total reservoir volumetric decrease of 8×10^{-6}/psi. The pressure drop, assuming no dissolved gases or influx of water from the shale required to produce the 20 year cumulative amount of water is

$$\frac{3.5 \times 10^{-2}}{8 \times 10^{-6}} = 4375 \text{ psi}$$

Initially the well-head pressure would be about 4500 psi and would drop to about 100 psi after 20 years of production, again assuming no gas drive or influx of water from the shale. A pressure drop in the reservoir of 4375 psi implies a pore collapse

of ($3 \times 10^{-6} \times 4375$) or 1.3% volume in 2640 ft. of sand. Assuming approximately 1/3 of pore collapse to be in vertical direction we get about 11 feet of subsidence at depth in 20 years of production. In practice, waste water would be re-injected into normal pressured reservoirs at depths of 5000 to 6000 feet thus decreasing the surface effects of subsidence at a depth of 12000 feet.

Single Well Production

Calculations of power production from a single well are more pertinent to this feasibility study than are production figures for the entire reservoir. The parameters used in the following calculations are from the Sebastian Site in south Texas.

Depth of Sand	14,300-15,000 ft.
Thickness	700 ft.
Temperature	320° F
Reservoir Pressure (Ave)....	12,000 psi
Total Salinity..............	2000-6000 ppm
Permeability	0.10 to 0.14 Darcy
Porosity (approx)...........	0.25
Area of reservoir...........	300 sq. miles or more
Hydrostatic pressure for 14,600 ft. head	6330 psi
Well-head pressure	over 5000 psi

We again take the daily production from a well to be 50,000 bbls. or 2.1×10^6 gal./day. Electrical power can be derived from both the heat and mechanical energy stored in the water. Considering five years production from a single well, we would expect no appreciable decrease in well-head pressure. If the water temperature

is dropped from 320° F to 200° F, then 1000 BTU/gal. would be available. Assuming 10% efficiency in the heat exchanger and electrical power generator we would require 34 gal. per kwatt-hour or 816 gal./day to produce one kwatt. A single well should then produce over 2.5 mega-watts from the heat energy alone.

From mechanical energy we can expect to produce, with a 5000 psi pressure drop, about one kwatt-hour from 50 gal. of water. The mechanical power production would be $2.1 \times 10^6/(50)(24)$ = 1750 kwatts giving a total electrical power production of over 4 megawatts from one well.

The water produced would have a total salinity of about 5000 ppm or less, and the salinity should decrease with production depending upon the amount of water given off by the shales as the reservoir pressure begins to drop. We assume, based on data from other wells in the south Texas-Gulf coast region, that the reservoir water would contain about 0.25 cu. ft. of methane per gal. and about an equal amount of carbon dioxide. The methane would be recovered and the carbon dioxide could be collected or vented. Total methane production should be about 2×10^8 cu. ft./year. The slightly saline water produced by the well can be re-injected into very saline, normal pressured reservoir sands at depths of 5000 to 6000 ft.

Pilot Project

Our studies show that it is feasible to construct and operate a pilot plant for electrical power production using water from a single well in south Texas. Over 4 mega-watts of power could be produced from a single well; two billion cu.ft./year of methane would be produced as a by-product. Based on geological and environmental considerations, we find it feasible to locate the project at either the Sebastian or Port Mansfield sites discussed in this report. Based on more complete subsurface information, we prefer the Sebastian site. The principle objectives of a 5 year pilot project would be as follows:

(1) Demonstrate the feasibility of power production from thermal and mechanical energy stored in a geo-pressured sub-surface reservoir.

(2) Determine the production-pressure history of the well. Evaluate the contributions to production from gas drive and de-watering of the shale.

(3) Study the change in water chemistry with production as an indication of the change in shale composition in the reservoir.

(4) Develop optimum methods for converting the mechanical energy stored in the over-pressured water to electrical energy.

(5) Investigate the use of the facility as a stand-by power facility. Determine the effect of shuting-in the production for long periods of time.

(6) Determine, by use of sensitive instrumentation, the surface effects resulting from withdrawal and re-injection of the large amounts of water required for power production.

There would appear to be no alternative to the construction and operation of a pilot project if the above objectives are to be achieved. Although the basic principal of extraction of electrical power from hot, high-pressure water appears to be straightforward, there are no doubt many engineering problems which can only be recognized and solved by actually building the plant. The operational history of the project for the first few years will be critical in evaluating the roles of gas drive and de-watering of shale in maintaining well-head pressures. There does not seem to be any reliable _a priori_ technique to evaluate these factors. Although finite element theory may offer some pre-drilling information, the effect of re-injection on preventing subsidence can be finally resolved only by operating the pilot project.

The pilot project in the south Texas Gulf Coast would serve as a world model. The pertinent structural and stratigraphic

characteristics of the Gulf Coast are not unique. On the contrary, as has been pointed out earlier, the distribution of deep abnormally pressured sedimentary basins is world wide. Information obtained from the Gulf Coast pilot project would be directly applicable to most other abnormally pressured basins. The Gulf Coast is unique in that extensive exploration for gas and petroleum have resulted in a comprehensive knowledge of the geopressured zone. The top of geopressured zone has been mapped over most of the region, and thousands of well logs have provided information on salinities and temperatures of the formation waters. In addition, the Gulf Coast is logistically very handy for experimentation -- both in nearness and climate. Thus, this region seems ideal to serve as the site of an experimental program which would have global implications.

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APPENDIX 1

WELL LOGS PROVIDING DATA FOR STUDY

County	Operator and Fee	Total Depth
H-56	Cities Service, *et al.*, Rio Farms, Inc.	10,005
H-55	General Crude, H. E. Stegle	10,515
H-57	Standard of Texas, Rio Farms	17,000
H-58	Hydrocarbon, Bell, *et al.*	8,516
H-59	Oatman, *et al.*, M. A. Giese, *et al.*	9,524
C-1	Magnolia, *et al.*, M. Giese	10,216
C-2	Texaco., C. A. Johnson	16,213
C-3	Humble, L. Austin	11,180
C-177	Gulf, J. H. McDaniel	15,475
C-4	Magnolia, F. Armandaiz Heirs	9,620
C-165	Geo. D. Weatherston, Milton B. Clapp	8,515
C-5	Gulf Coast Schussler	10,986
C-145	Royal Res., O. Cook	9,017
C-6	Amerada, W. O. Huff	11,025
C-141	A-15 Kerr, McGee, O. Cook	10,017
C-124	A. R. Smith, J. R. Jones	9,050
C-186	Royal Resound and Exploration Unlimited, Inc., W. R. Lang	9,011
C-8	J. F. Anderson, M. Tuffitl Heirs	5,290
H-1138	Texaco, W. Harbison	13,525
H-303	J. W. Voss, Prop., J. R. Wade	10,530
H-108	R. Lacey, R. Lacey	10,713
H-464	Tidewater Hoblitzelle, *et al.*	10,501
C-118	Hydrocarbon, J. O. Bevers	15,500
H-552	MacDonald Oil Corporation, Estate of Lincold Pettus	9,004
C-29	Hankins and Co., L. A. Rohman	10,515
C-183	Chevron, J. A. Rodriguez	18,488
W-104	Carrl O., *et al.*, B. A. Nance	10,022
W-84	Mound Co., P. R. Oaks	10,025
W-83	Stanalind Oil and Gas Co., Mrs. Lena Boden	12,525
W-82	Union Prod., C. Gillit	12,049
W-113	Sun Oil, Santa Rosa, Inc.	11,520
W-112	Magnolia, Seliger	11,500
W-141	Shell, McCullough	16,002
W-46	Gulf, Dan Stone	12,520
W-111	H. L. Hunt, C. E. Wertz	11,053
W-146	J. Haman, Inness G. Un	10,820
C-30	Goldrus, Parker Bros.	10,007
W-92	Mound Co., J. J. Dudansing	10,920
C-31	J. W. Voss Drilling, G. W. Duncan, 1-A	12,517

C-37	Shell Oil Co., Paul Hulsey	11,106
C-33	Wilson Exploration, Bowie Un 12	12,557
C-32	Wilson Exploration Assoc. O. and Exploration	11,471
C-77	Superior, San Benito Unit 11	10,629
Ke-407	Mobil, St. Lease 57948, Laguna Madre St. Tr. 406, No. 1	18,620
Ke-118	Sunray, et al., St. Tr. 405, No. 1	10,267
Ke-117	McWood Corporation (Continental), St. Tr. 393, No. 1	13,000
Ke-353	Continental St. Tract 390	10,020
Ke-16	Humble, St. Tract 384	12,000
Ke-408	Midwest Oil, St. Tr. 441	11,530
W-2	Humble, Sanz Ranch Tenercas #2	13,247
Ke-173	Humble, King Ranch, San Jose Parral, #2	12,005
Ke-174	Humble, King Ranch, San Jose Parral, #1	12,000
Ke-25	Humble, King Ranch, San Jose Parral, #3	10,002
W-148	American Petr. Exploration, Kerlin	10,401
W-90	Pan American Exploration, Mano, C. N. deArmendaiz	16,904
C-14	Shell Oil Co., Continental Fee	15,001
W-32	Humble, King Ranch #2	11,990
W-31	Humble, King Ranch #1	11,189
W-33	Humble Sauz Ranch, Nopal #6	10,000
C-23	Magnolia Petroleum Co., Gilbert Kerlin	17,116
C-22	Gulf Oil Co., Gilbert Kerlin, et al., 1-A	11,700
C-24	Gulf Oil Co., Gilbert Kerlin, 2-A	13,220
W-287	Humble, Sauz Ranch, Nopal	10,188
W-140	Humble, Sauz Ranch 1-13	9,492
W-30	Humble, Sauz Ranch C-3	10,619
W-286	Humble, King Ranch, et al., #5	11,000
W-78	Texas Co., So. Fruit Ld. and Irr.	10,516
*Ke-29	Humble, King Ranch, Tio Moya	15,975
Ke-28	Humble O. and Ref. Co., Tio Moya Pasture	12,000
Ke-214	Humble, Sauz Ranch Tenercas #3	13,509
W-3	Humble, Sauz Ranch Tenercas #1	12,501
W-5	Humble, O. and Ref. Co., Sauz Ranch Tenercas	10,000
Ke-167	Austral Oil Co., M. F. Garcia, et al.	14,603
Ke-168	Humble, King Ranch, Loma Prieto #2	14,000
Ke-39	Standard of Texas, M. F. Garcia, et al.	12,000
W-143	Humble, Sauz Ranch, Jardin #1	12,290
W-93	Humble, W. S. Murphy #1	11,207
W-101	Humble, C. L. Deming #1	12,003
W-104	Humble, M. F. Garcia, #2	13,100
W-102	Humble, Garcia L. and L. 1-13	12,500
W-73	Texaco, Yturrio 10-A, Raymondville Field	16,122
W-90	Pan American Pet., Maria C. N. deArmendaiz #1 Paso Real Field	16,904

*1400 ft. water well nearby

W-120	Magnolia, F. Armendaiz, #3, Paso Real Field	11,000
W-287	Humble, Sauz Ranch, Nopal 1-2	10,186
W-30	Humble, Sauz Ranch, Nopal 13-3	10,619
W-31	Humble, King Ranch, *et al.*, #1	11,189
W-32	Humble, King Ranch, *et al.*, #2	11,990
W-33	Humble, King Ranch, Sauz Ranch Nopal #6	10,000
W-286	Humble, King Ranch, *et al.*, #5	11,000

Appendix 2

Salinities, Pressures and Corrected Temperatures for Aquifers in the Sebastian, Port Mansfield and Corpus Christi Areas, Texas.

```
C       PROGRAM SPSAL
        DIMENSION MC(2),YTAB(34),XTAB(34),Y1TAB(6,34),X1TAB(6,34),
       1TEMP(6),RS75(34),SAL(34)
        TEMP(1)=75.
        TEMP(2)=100.
        TEMP(3)=150.
        TEMP(4)=200.
        TEMP(5)=300.
        TEMP(6)=400.
        READ 1000,(RS75(I),SAL(I),I=1,34)
 1000   FORMAT (2F10.3)
        DO 1020 I=1,6
        READ 1010,(Y1TAB(I,J),X1TAB(I,J),J=1,2)
        READ 1010,(Y1TAB(I,J),X1TAB(I,J),J=3,34)
 1010   FORMAT (8F10.5)
 1020   CONTINUE
        PRINT 5
      5 FORMAT(1H1,1X,*WELL NO.*,3X,*DEPTH*,4X,*THICK*,2X,*MUD WT*,2X,*TEM
       1P*,2X,*COR TEMP*,2X,*SAL PPM*,4X,*PSI*,3X,*LOG*,3X,*MUD*,3X,*SP*,
       2///)
     10 READ 12,MC(1),MC(2),DTAQ,DBAQ,RUN, TYFL,XMW,RM,BHT1,BHT2,
       1BHD1,BHD2,SP
     12 FORMAT (A4,I4,2I10,I2,A4,F5.1,F5.2,2F5.0,2F10.0,F5.0)
        IF(MC(2)-0)325,325,15
C       COMPUTE MIDPOINT OF AQUIFER
     15 DMAQ=(DBAQ-DTAQ)/2.+DTAQ
C       COMPUTE FORMATION TEMPERATURE
        GRAD=(BHT2-BHT1)/(BHD2-BHD1)
        FT=(DMAQ-BHD1)*GRAD+BHT1
        E=FT-8.819*DMAQ**3.*1.E-12-2.143*DMAQ**2.*1.E-8+.375*DMAQ*
       11.E-03-1.018
C       USE CHART GEN-9 TO OBTAIN RM AT FORMATION TEMPERATURE (RFT)
        R75=(RM*(BHT2+7.0))/82.
        RFT=(R75*82.)/(FT+7.)
C       DETERMINE  RESISTANCE OF MUD FILTRATE (RMF)
        IF(XMW-10.)30,20,20
     20 IF(XMW-16.)40,40,30
     30 RMF=.75*RFT
        GO TO 100
     40 CONTINUE
     44 IF(XMW-11.)46,46,55
     46 RMF1=(.4342944819*ALOG(RFT)-.07679)/.94155
        RMF2=(.4342944819*ALOG(RFT)-.13630)/.94624
        DXM=XMW-10.
     47 RMF1=EXPF(RMF1/.4342944819)
        RMF2=EXPF(RMF2/.4342944819)
        RMF=(RMF2-RMF1)*DXM+RMF1
        GO TO 100
     55 IF(XMW-12.)56,56,65
     56 RMF1=(.4342944819*ALOG(RFT)-.15280)/.95545
        RMF2=(.4342944819*ALOG(RFT)-.22531)/.95545
        DXM=XMW-11.
        GO TO 47
     65 IF(XMW-13.)66,66,75
     66 RMF1=(.4342944819*ALOG(RFT)-.22531)/.95545
        RMF2=(.4342944819*ALOG(RFT)-.30103)/.95545
        DXM=XMW-12.
        GO TO 47
     75 IF(XMW-14.)76,76,85
     76 RMF1=(.4342944819*ALOG(RFT)-.30103)/.95545
        RMF2=(.4342944819*ALOG(RFT)-.36680)/.95545
```

```
      DXM=XMW-13.
      GO TO 47
   85 RMF1=(.4342944819*ALOG(RFT)-.36680)/.95545
      RMF2=(.4342944819*ALOG(RFT)-.39794)/.95545
      DXM=(XMW-14.)/2.
      GO TO 47
  100 CONTINUE
C     DETERMINE EQUIVALENT RESISTANCE OF MUD FILTRATE (RMF)E
  104 IF(FT-100.)106,106,110
  106 J=1
      GO TO 130
  110 IF(FT-150.)112,112,115
  112 J=2
      GO TO 130
  115 IF(FT-200.)118,118,120
  118 J=3
      GO TO 130
  120 IF(FT-300.)122,122,125
  122 J=4
      GO TO 130
  125 J=5
  130 CONTINUE
      R75=(RMF*(FT+7.))/82.
      IF(R75-0.1)2020,102,102
  102 RMFE=.85*RMF
      GO TO 4000
 2020 DO 133 I=1,34
      YTAB(I)=Y1TAB(J,I)
      XTAB(I)=X1TAB(J,I)
  133 CONTINUE
      DO 135 K=1,34
      IF(RMF-YTAB(K))140,140,135
  135 CONTINUE
  140 RMF1=AGRAN(RMF,YTAB(K-2),XTAB(K-2))
  145 DO 148 I=1,34
      YTAB(I)=Y1TAB(J+1,I)
  148 XTAB(I)=X1TAB(J+1,I)
      DO 147 K=1,34
      IF(RMF-YTAB(K))150,150,147
  147 CONTINUE
  150 RMF2=AGRAN(RMF,YTAB(K-2),XTAB(K-2))
      GRAD=(RMF2-RMF1)/(TEMP(J+1)-TEMP(J))
      RMFE=RMF1+(FT-TEMP(J))*GRAD
 4000 CONTINUE
C     USE CHART SP-1 TO FIND (RMF)E/(RW)E
      IF(FT-100.)155,155,160
  155 RAT1=-(.74036/50.)*SP
      RAT2=-(.95424/70.)*SP
      T1=50.
      T2=100.
      GO TO 190
  160 IF(FT-150.)162,162,165
  162 RAT1=-(.95424/70.)*SP
      T1=100.
      RAT2=-(1./80.)*SP
      T2=150.
      GO TO 190
  165 IF(FT-200.)167,167,170
  167 RAT1=-(1./80.)*SP
      T1=150.
      RAT2=-(.81291/70.)*SP
      T2=200.
```

```
      GO TO 190
  170 IF(FT-250.)172,172,175
  172 RAT1=-(.81291/70.)*SP
      T1=200.
      RAT2=-(1.27875/120.)*SP
      T2=250.
      GO TO 190
  175 IF(FT-300.)177,177,180
  177 RAT1=-(1.27875/120.)*SP
      T1=250.
      RAT2=-(1./100.)*SP
      T2=300.
      GO TO 190
  180 IF(FT-350.)182,182,185
  182 RAT1=-(1./100.)*SP
      T1=300.
      T2=350.
      RAT2=-(.65321/70.)*SP
      GO TO 190
  185 RAT1=-(.65321/70.)*SP
      T1=350.
      RAT2=-(1.41497/160.)*SP
      T2=400.
  190 CONTINUE
      RAT1=EXPF(RAT1/.4342944819)
      RAT2=EXPF(RAT2/.4342944819)
      IF(SP)195,200,205
  200 RAT=1.0
      GO TO 206
  195 GRAD=(RAT2-RAT1)/50.
      RAT=(FT-T1)*GRAD+RAT1
      GO TO 206
  205 GRAD=(RAT1-RAT2)/50.
      RAT=-GRAD*(FT-T1)+RAT1
  206 CONTINUE
C     CALCULATE THE EQUIVALENT RESISTANCE OF THE WATER.(RW)E
      RWE=RMFE/RAT
C     USE CHART SP-2 TO DETERMINE RESISTANCE OF THE WATER -RW
      DO 1330 I=1,30
      YTAB(I)=Y1TAB(J,I)
      XTAB(I)=X1TAB(J,I)
 1330 CONTINUE
      DO 210 K=1,30
      IF(RWE-XTAB(K))215,215,210
  210 CONTINUE
  215 RW1=AGRAN(RWE,XTAB(K-2),YTAB(K-2))
  220 DO 230 I=1,30
      YTAB(I)=Y1TAB(J+1,I)
  230 XTAB(I)=X1TAB(J+1,I)
      DO 240 K=1,30
      IF(RWE-XTAB(K))245,245,240
  240 CONTINUE
  245 RW2=AGRAN(RWE,XTAB(K-2),YTAB(K-2))
      GRAD=(RW2-RW1)/(TEMP(J+1)-TEMP(J))
      RW=RW1+(FT-TEMP(J))*GRAD
C     USE CHART GEN-9 TO DETERMINE SALINITIES
      RW75=(RW*(FT+7.0))/82.
      DO 260 I=1,34
      IF(RW75-RS75(I))270,270,260
  260 CONTINUE
  270 GRAD=(RS75(I)-RS75(I-1))/(SAL(I)-SAL(I-1))
      GRAD= 1./GRAD
```

```
      DSAL=(RW75-RS75(I-1))*GRAD+SAL(I-1)
      TH=DBAQ-DTAQ
      P=.052*XMW*DMAQ
      PRINT 300,MC(1),MC(2),DTAQ,DBAQ,TH,XMW,FT,E,DSAL,P,RUN,TYFL,SP
  300 FORMAT(1X,A4,I3,1X,I5,1H-,I5,I5,3X,F5.1,1X,F6.0,2X,F6.0,3X,F8.0,
     11X,F8.0,1X,I2,3X,A4,1X,F5.0)
      GO TO 10
  325 END
```

```
IOGRAM ALLOCATION

00011 MC        00013 YTAB      00117 XTAB      00223 Y1TAB
01053 X1TAB     01703 TEMP      01717 RS75      02023 SAL
02127 I         02130 J         02131 K         02132 DTAQ
02134 DBAQ      02136 RUN       02140 TYFL      02142 XMW
02144 RM        02146 BHT1      02150 BHT2      02152 BHD1
02154 BHD2      02156 SP        02160 DMAQ      02162 GRAD
02164 FT        02166 E         02170 R75       02172 RFT
02174 RMF       02176 RMF1      02200 RMF2      02202 DXM
02204 RMFE      02206 RAT1      02210 RAT2      02212 T1
02214 T2        02216 RAT       02220 RWE       02222 RW1
02224 RW2       02226 RW        02230 RW75      02232 DSAL
02234 TH        02236 P

IBPROGRAMS REQUIRED

ALOG      EXPF      AGRAN
IE END
```

WELL NO.	DEPTH (FT)	THICK (FT)	MUD WT (LB/GAL)	TEMP °F	COR TEMP (°F)	SAL PPM	PSI	LOG	MUD	SP
H 56	8035- 8065	30	11.7	181.	210.	38130.	4898.	1	PEGA	-41.
H 56	8100- 8115	15	11.7	182.	210.	29147.	4933.	1	PEGA	-33.
H 56	8160- 8190	30	11.7	183.	212.	19110.	4974.	1	PEGA	-20.
H 56	8220- 8230	10	11.7	184.	212.	26335.	5004.	1	PEGA	-30.
H 56	8265- 8315	50	11.7	185.	213.	27228.	5044.	1	PEGA	-31.
H 56	8370- 8380	10	11.7	186.	215.	19104.	5095.	1	PEGA	-20.
H 56	8580- 8600	20	11.8	189.	218.	35202.	5271.	2	PEGA	-33.
H 56	8720- 8960	240	11.8	193.	222.	48943.	5424.	2	PEGA	-45.
H 56	9030- 9070	40	11.8	196.	226.	26020.	5553.	2	PEGA	-25.
H 56	9100- 9160	60	11.8	197.	227.	22598.	5602.	2	PEGA	-20.
H 56	9210- 9255	45	11.8	198.	229.	19214.	5665.	2	PEGA	-15.
H 56	9640- 9650	10	11.8	205.	236.	6981.	5918.	2	PEGA	9.
H 56	9685- 9700	15	11.8	205.	237.	5979.	5947.	2	PEGA	12.
H 56	9720- 9770	50	11.8	206.	238.	4014.	5980.	2	PEGA	20.
H 57	8070- 8100	30	10.4	171.	199.	65790.	4372.	1	BA	-43.
H 57	8145- 8170	25	10.4	172.	200.	50641.	4412.	1	BA	-33.
H 57	8195- 8215	20	10.4	172.	201.	43660.	4437.	1	BA	-27.
H 57	8265- 8280	15	10.4	173.	202.	41174.	4474.	1	BA	-25.
H 57	8320- 8370	50	10.4	174.	203.	50745.	4513.	1	BA	-33.
H 57	8405- 8415	10	10.4	175.	204.	43729.	4548.	1	BA	-27.
H 57	8450- 8470	20	10.4	175.	204.	50812.	4575.	1	BA	-33.
H 57	8620- 8655	35	10.4	177.	207.	38142.	4671.	1	BA	-22.
H 57	8730- 9020	290	10.4	180.	210.	89027.	4800.	1	BA	-57.
H 57	9090- 9220	130	10.4	184.	214.	51266.	4951.	1	BA	-33.
H 57	9400- 9430	30	10.4	187.	218.	27341.	5092.	1	BA	-12.
H 57	11790-11805	15	14.0	232.	265.	24730.	8589.	2	GA	6.
H 57	12125-12135	10	14.0	239.	273.	24890.	8831.	2	GA	6.
H 57	13680-13690	10	15.1	273.	305.	19280.	10745.	3	GA	9.
H 57	14325-14335	10	15.1	286.	317.	20809.	11252.	3	GA	7.
H 57	15950-16020	70	15.1	316.	343.	34630.	12551.	4	GBA	5.
H 57	16130-16140	10	15.1	318.	345.	29839.	12669.	4	GBA	10.
H 57	16175-16185	10	15.1	319.	346.	32736.	12705.	4	GBA	7.
H 57	16230-16290	60	15.1	321.	347.	28395.	12767.	4	GBA	12.
H 58	8035- 8045	10	10.5	176.	204.	27618.	4390.	1	DP	-28.
H 58	8090- 8130	40	10.5	177.	205.	27586.	4428.	1	DP	-28.
H 58	8185- 8200	15	10.5	178.	206.	24085.	4473.	1	DP	-24.
H 58	8220- 8230	10	10.5	178.	207.	32759.	4491.	1	DP	-33.
H 58	8325- 8335	10	10.5	180.	209.	24679.	4548.	1	DP	-25.
H 58	8430- 8440	10	10.5	181.	210.	20458.	4606.	1	DP	-19.
H 59	7990- 8000	10	10.9	173.	201.	21409.	4532.	1	CP	-31.
H 59	7990- 8000	10	10.9	173.	201.	21409.	4532.	1	CP	-31.
H 59	8073- 8085	12	10.9	174.	203.	33053.	4579.	1	CP	-44.
H 59	8220- 8270	50	10.9	176.	205.	30504.	4673.	1	CP	-42.
H 59	8480- 8495	15	10.9	179.	208.	54206.	4811.	1	CP	-62.
H 59	8555- 8565	10	10.9	180.	209.	41423.	4852.	1	CP	-52.
H 59	8645- 8658	13	10.9	181.	211.	25471.	4904.	1	CP	-37.
H 59	8860- 8880	20	10.9	184.	214.	45215.	5028.	1	CP	-55.
H 59	8970- 8985	15	10.9	185.	215.	23952.	5088.	1	CP	-35.
H 59	9090- 9135	45	10.9	187.	217.	20384.	5165.	1	CP	-30.
H 59	9295- 9310	15	10.9	189.	220.	18446.	5273.	1	CP	-27.
H 59	9430- 9450	20	10.9	191.	222.	15312.	5351.	1	CP	-22.
H 108	7740- 7930	190	10.4	150.	178.	68163.	4237.	3	I	-90.
H 108	7980- 7995	15	10.4	160.	188.	15648.	4320.	3	I	-42.
H 108	8125- 8160	35	12.5	164.	192.	43658.	5293.	4	I	-55.
H 108	8230- 8260	30	12.5	164.	193.	33067.	5359.	4	I	-45.
H 108	8345- 8435	90	12.5	165.	194.	33009.	5453.	4	I	-45.
H 108	8465- 8520	55	12.5	165.	194.	27697.	5520.	4	I	-40.
H 108	8560- 8575	15	12.5	166.	195.	27678.	5569.	4	I	-40.
H 108	8635- 8705	70	12.5	166.	196.	27652.	5635.	4	I	-40.

H	108	8020.	8034	14	10.4	163.	191.	39765.	4341.	3	I	.70.
H	108	8795.	9115	320	12.6	155.	215.	50000.	5867.	5	I	.60.
H	108	9140.	9180	40	12.6	172.	202.	23167.	6002.	5	Θ	.34.
H	108	9210.	9230	20	12.6	174.	205.	38690.	6041.	5	Θ	.50.
H	108	9270.	9300	30	12.6	177.	208.	33297.	6084.	5	Θ	.45.
H	108	9470.	9740	270	12.6	191.	223.	49970.	6293.	5	Θ	.60.
H	108	9820.	9870	50	12.6	202.	233.	13580.	6450.	5	Θ	.20.
H	108	9915.	9930	15	12.6	205.	237.	18337.	6501.	5	Θ	.25.
H	108	10040.	10080	40	13.5	210.	242.	27415.	7062.	6	I	.37.
H	108	10100.	10180	80	13.5	211.	243.	18756.	7118.	6	I	.25.
H	108	10270.	10330	60	13.5	213.	245.	35045.	7231.	6	I	.44.
H	108	10410.	10430	20	13.5	214.	246.	22459.	7315.	6	I	.31.
H	303	8050.	8065	15	12.1	176.	204.	22333.	5070.	1	L	.20.
H	303	8230.	8245	15	12.1	178.	207.	36646.	5183.	1	L	.35.
H	303	8385.	8400	15	12.1	180.	209.	18739.	5281.	1	L	.15.
H	303	8525.	8540	15	12.1	182.	211.	27739.	5369.	1	L	.27.
H	303	8620.	8700	80	12.1	184.	213.	24851.	5449.	1	L	.24.
H	303	8815.	8830	15	12.1	186.	215.	18759.	5551.	1	L	.15.
H	303	8865.	8905	40	12.1	186.	216.	23578.	5590.	1	L	.22.
H	303	8940.	8990	50	12.1	187.	218.	19966.	5641.	1	L	.17.
H	303	9145.	9250	105	12.1	190.	221.	25528.	5787.	1	L	.25.
H	303	9340.	9360	20	12.1	192.	223.	18774.	5883.	1	L	.15.
H	303	9380.	9435	55	12.1	193.	224.	22158.	5919.	1	L	.20.
H	303	9465.	9490	25	12.1	194.	225.	23464.	5963.	1	L	.22.
H	303	9625.	9640	15	12.1	196.	227.	18778.	6061.	1	L	.15.
H	303	9695.	9775	80	12.1	197.	228.	18153.	6125.	1	L	.14.
H	464	7950.	8015	65	12.8	180.	208.	55007.	5313.	1	GA	.31.
H	464	8060.	8070	10	12.8	181.	210.	47146.	5368.	1	GA	.25.
H	464	8110.	8180	70	12.8	182.	211.	49366.	5421.	1	GA	.27.
H	464	8270.	8350	80	12.8	185.	213.	49464.	5501.	1	GA	.27.
H	464	8385.	8395	10	12.8	186.	215.	42444.	5584.	1	GA	.21.
H	464	8425.	8570	145	12.8	187.	216.	52493.	5656.	1	GA	.29.
H	464	8650.	8700	50	12.8	189.	219.	49692.	5774.	1	GA	.27.
H	464	8730.	8800	70	12.8	191.	220.	51207.	5834.	1	GA	.28.
H	464	9110.	9245	135	12.8	196.	227.	34080.	6109.	1	GA	.13.
H	464	9510.	9680	170	16.3	206.	238.	12644.	8133.	2	AB	.27.
H	552	7880.	8175	295	10.9	174.	202.	62641.	4550.	1	O	.59.
H	552	8220.	8280	60	10.9	177.	205.	29314.	4676.	1	D	.32.
H	552	8320.	8360	40	10.9	178.	207.	25469.	4727.	1	D	.28.
H	552	8470.	8550	80	10.9	180.	209.	19688.	4823.	1	D	.20.
H	552	8575.	8680	105	10.9	181.	211.	19686.	4890.	1	D	.20.
H	552	8720.	8760	40	10.9	153.	212.	29964.	4954.	1	D	.33.
H	552	8880.	8990	110	10.9	185.	215.	36049.	5064.	1	D	.38.
C	6	7750.	8200	450	11.8	173.	201.	62392.	4893.	1	XE	.50.
C	6	8380.	8425	45	11.8	178.	207.	59222.	5156.	1	XE	.48.
C	6	8460.	8510	50	11.8	179.	208.	38974.	5206.	1	XE	.32.
C	6	8630.	8650	20	11.8	181.	210.	38967.	5302.	1	XE	.32.
C	6	8745.	8770	25	11.8	182.	212.	29951.	5374.	1	XE	.24.
C	6	8785.	8835	50	11.8	133.	213.	60932.	5406.	1	XE	.42.
C	6	8865.	8940	75	11.8	184.	214.	38020.	5463.	1	XE	.31.
C	6	9000.	9060	60	11.8	186.	216.	41262.	5541.	1	XE	.34.
C	6	9150.	9400	250	11.8	189.	219.	41341.	5691.	1	XE	.34.
C	6	9430.	9475	45	11.8	191.	222.	24461.	5800.	1	XE	.18.
C	6	9525.	9580	55	11.8	192.	223.	39037.	5861.	1	XE	.32.
C	6	9655.	10950	1295	11.8	201.	233.	31558.	6322.	1	XE	.25.
C	6	8255.	8345	90	11.8	177.	205.	59204.	5093.	1	XE	.48.
C	1	8075.	8100	25	10.9	165.	193.	47244.	4584.	3	I	.58.
C	1	8300.	8320	20	10.9	167.	195.	42511.	4710.	3	I	.54.
C	1	8400.	8420	20	10.9	167.	196.	78790.	4767.	3	I	.80.
C	1	8450.	8510	60	10.9	168.	197.	78775.	4806.	3	I	.80.
C	1	8770.	8810	40	10.9	169.	198.	22335.	4982.	4	I	.40.
C	1	8910.	8945	35	10.9	169.	199.	20745.	5060.	4	I	.38.
C	1	9050.	9115	65	10.9	169.	200.	20737.	5148.	4	I	.38.
C	1	9170.	9220	50	10.9	169.	200.	17938.	5212.	4	I	.34.
C	1	9360.	9420	60	10.9	170.	201.	17930.	5322.	4	I	.34.
C	1	9475.	9515	40	11.8	170.	201.	20689.	5826.	5	I	.38.

C	1	9540- 9565	25	11.8	171.	202.	48810.	5861.	5	I	.66.
C	1	9630- 9710	80	11.8	172.	203.	80947.	5934.	5	I	.88.
C	1	9740- 9870	130	11.8	173.	205.	35450.	6016.	5	I	.54.
C	3	8015- 8040	25	10.9	161.	189.	54614.	4550.	4	H	.34.
C	3	8110- 8130	20	10.9	162.	190.	45647.	4602.	4	H	.27.
C	3	8160- 8230	70	10.9	163.	191.	56101.	4645.	4	H	.35.
C	3	8335- 8465	130	11.5	167.	196.	84253.	5023.	5	H	.50.
C	3	8515- 8555	40	11.5	167.	196.	94462.	5104.	5	H	.55.
C	3	8580- 8640	60	11.5	168.	197.	82117.	5149.	5	H	.49.
C	3	8700- 8780	80	11.5	169.	199.	129036.	5227.	5	H	.70.
C	3	8825- 8850	25	11.5	171.	200.	94626.	5285.	5	H	.55.
C	3	8885- 9120	235	11.5	173.	203.	124809.	5383.	5	H	.68.
C	3	9200- 9400	200	11.5	177.	207.	88988.	5561.	5	H	.52.
C	3	9450- 9495	45	11.5	179.	210.	51189.	5665.	5	H	.28.
C	3	9545- 9580	35	11.5	180.	211.	111227.	5718.	5	H	.62.
C	3	9610- 9750	140	11.5	182.	213.	51362.	5789.	5	H	.28.
C	3	9800-10080	280	11.9	190.	222.	58759.	6151.	6	H	.33.
C	3	10170-10260	90	11.9	190.	222.	57504.	6321.	6	H	.32.
C	3	10350-10430	80	11.9	194.	226.	43530.	6429.	6	H	.21.
C	3	10480-10580	100	11.9	197.	229.	36670.	6516.	6	H	.15.
C	3	10800-11170	370	11.9	206.	239.	42536.	6798.	6	H	.20.
C	5	8000- 8100	100	11.5	166.	194.	118992.	4814.	1	H	.42.
C	5	8000- 8100	100	11.5	166.	194.	118992.	4814.	1	H	.42.
C	5	8115- 8380	265	11.5	168.	196.	125715.	4932.	1	H	.45.
C	5	8420- 8500	80	11.5	170.	199.	140294.	5059.	1	H	.51.
C	5	8560- 8605	45	11.5	172.	201.	104426.	5132.	1	H	.36.
C	5	8655- 8700	45	11.5	173.	202.	99393.	5189.	1	H	.34.
C	5	8720- 8800	80	11.5	174.	203.	135219.	5238.	1	H	.49.
C	5	8835- 9220	385	11.5	177.	207.	132687.	5398.	1	H	.48.
C	5	9250- 9260	10	11.5	179.	210.	82291.	5534.	1	H	.25.
C	5	9295- 9390	95	11.5	180.	211.	115454.	5587.	1	H	.40.
C	5	9420- 9610	190	12.0	190.	221.	95647.	5937.	2	H	.40.
C	5	9420- 9610	190	12.0	179.	210.	110143.	5937.	2	H	.47.
C	5	9640- 9680	40	12.0	183.	214.	70647.	6028.	2	H	.26.
C	5	9755-10480	725	12.0	187.	219.	103449.	6313.	2	H	.44.
C	14	7960- 8030	70	11.4	164.	192.	71968.	4739.	2	PE	.15.
C	14	8090- 8210	120	11.4	165.	193.	78756.	4831.	2	PE	.20.
C	14	8230- 8280	50	11.4	166.	194.	88642.	4894.	2	PE	.25.
C	14	8350- 8380	30	11.4	167.	196.	/8879.	4959.	2	PE	.20.
C	14	8400- 8530	130	11.4	168.	197.	88849.	5018.	2	PE	.25.
C	14	8560- 8640	80	11.4	169.	198.	79024.	5098.	2	PE	.20.
C	14	8660- 8680	20	11.4	169.	199.	67919.	5140.	2	PE	.12.
C	14	8730- 8795	65	11.4	170.	200.	72468.	5194.	2	PE	.15.
C	14	8860- 8880	20	11.4	171.	201.	66483.	5258.	2	PE	.11.
C	14	12250-12290	40	14.1	220.	254.	44954.	8996.	7	PE	.18.
C	14	12310-12415	105	14.1	223.	256.	48066.	9064.	7	PE	.21.
C	14	12615-12635	20	14.1	228.	262.	52470.	9257.	7	PE	.25.
C	14	12655-12680	25	14.1	229.	262.	66067.	9288.	7	PE	.35.
C	14	12715-12735	20	14.1	231.	264.	46727.	9330.	7	PE	.20.
C	14	12790-12845	55	14.1	233.	266.	45597.	9398.	7	PE	.19.
C	14	12855-12880	25	14.1	234.	267.	18091.	9434.	7	PE	11.
C	14	12930-12990	60	14.1	236.	269.	59286.	9502.	7	PE	.31.
C	14	13080-13140	60	14.1	239.	272.	47410.	9612.	7	PE	.21.
C	14	13250-13270	20	14.1	243.	275.	52894.	9722.	7	PE	.26.
C	14	13365-13385	20	14.1	245.	278.	49997.	9807.	7	PE	.24.
C	14	13405-13420	15	14.1	246.	279.	40666.	9834.	7	PE	.15.
C	14	13460-13480	20	14.1	248.	280.	46119.	9876.	7	PE	.20.
C	14	13500-13520	20	14.1	248.	281.	40600.	9906.	7	PE	.15.
C	14	13550-13575	25	14.1	250.	282.	40565.	9944.	7	PE	.15.
C	14	13610-13645	35	14.1	251.	283.	37757.	9992.	7	PE	.12.
C	14	13750-13780	30	14.1	254.	286.	43859.	10092.	7	PE	.18.
C	14	13820-13835	15	14.1	256.	288.	39477.	10138.	7	PE	.14.
C	14	13855-14045	190	14.1	258.	290.	43784.	10228.	7	PE	.18.
C	14	14090-14105	15	14.1	262.	293.	44789.	10336.	7	PE	.19.
C	14	14170-14345	175	14.1	265.	297.	45756.	10454.	7	PE	.20.
C	14	14555-14625	70	14.1	273.	304.	45645.	10697.	7	PE	.20.

C	14	14875-14930	55	14.1	280.	310.	44544.	10927.	7	PE	.19.
C	24	8640- 8650	10	12.9	177.	207.	35771.	5799.	2	EP	.10.
C	24	8845- 8940	95	12.9	181.	211.	39692.	5965.	2	EP	.14.
C	24	9050- 9220	170	12.9	184.	215.	50803.	6128.	2	EP	.23.
C	24	9240- 9370	130	12.9	187.	218.	54039.	6242.	2	EP	.25.
C	24	9400- 9480	80	12.9	189.	220.	59478.	6332.	2	EP	.29.
C	24	9500- 9950	450	12.9	193.	225.	71215.	6524.	2	EP	.36.
C	24	10005-10245	240	12.9	199.	231.	47185.	6792.	2	EP	.19.
C	24	10285-10410	125	12.9	203.	235.	45996.	6941.	2	EP	.18.
C	24	10460-10690	230	12.9	206.	239.	43489.	7094.	2	EP	.16.
C	24	10750-10850	100	12.9	210.	242.	35273.	7245.	2	EP	.9.
C	24	10880-10950	70	12.9	211.	244.	39559.	7322.	2	EP	.13.
C	24	11030-11070	40	12.9	213.	246.	38524.	7412.	2	EP	.12.
C	24	11140-11160	20	12.9	215.	248.	42034.	7479.	2	EP	.15.
C	24	11255-11450	195	12.9	218.	251.	46605.	7615.	2	EP	.19.
C	24	11475-11695	220	12.9	222.	255.	47519.	7771.	2	EP	.20.
C	24	12675-12860	185	12.9	239.	272.	34220.	8564.	2	EP	.8.
C	24	12860-12920	60	12.9	241.	274.	19998.	8647.	2	EP	8.
C	141	8325- 8335	10	10.5	170.	199.	43034.	4548.	1	D	.48.
C	141	8370- 8425	55	10.5	171.	200.	39500.	4585.	1	D	.45.
C	141	8445- 8470	25	10.5	171.	200.	44235.	4618.	1	D	.49.
C	141	8500- 8805	305	10.5	174.	203.	123462.	4724.	1	D	.94.
C	141	8840- 8920	80	10.5	176.	206.	66544.	4848.	1	D	.65.
C	141	8970- 9035	65	10.5	177.	208.	74005.	4915.	1	D	.70.
C	141	9085- 9095	10	10.5	178.	209.	31778.	4963.	1	D	.38.
C	141	9140- 9270	130	10.5	180.	210.	80946.	5026.	1	D	.75.
C	141	9300- 9350	50	10.5	181.	212.	55821.	5091.	1	D	.58.
C	141	9410- 9440	30	10.5	182.	213.	31651.	5146.	1	D	.38.
C	141	9525- 9550	25	10.5	184.	215.	51423.	5207.	1	D	.55.
C	141	9630- 9750	120	10.5	185.	217.	49897.	5291.	1	D	.54.
C	141	9790- 9910	120	10.5	187.	219.	38242.	5378.	1	D	.44.
W	104	8060- 8130	70	10.5	173.	201.	43689.	4420.	1	IP	.73.
W	104	8160- 8200	40	10.5	174.	202.	23996.	4466.	1	IP	.54.
W	104	8495- 8595	100	10.5	178.	207.	42123.	4666.	1	IP	.72.
W	104	8860- 8900	40	10.5	182.	212.	7554.	4848.	1	IP	.26.
W	104	9085- 9100	15	10.5	185.	215.	7174.	4965.	1	IP	.25.
W	104	9140- 9190	50	10.5	186.	216.	9662.	5004.	1	IP	.32.
W	104	9265- 9300	35	10.5	187.	218.	9271.	5068.	1	IP	.31.
W	104	9445- 9525	80	10.5	190.	221.	16596.	5179.	1	IP	.44.
W	104	9670- 9710	40	10.5	192.	223.	12277.	5291.	1	IP	.37.
W	104	9750- 9780	30	10.5	193.	224.	21797.	5332.	1	IP	.[illegible].
W	104	9865-10023	158	10.5	195.	227.	23679.	5429.	1	IP	.55.
C	22	7950- 8775	825	12.5	188.	217.	105785.	5436.	3	AE	.63.
C	22	8800- 8920	120	12.5	178.	208.	73280.	5759.	4	AE	.46.
C	22	8970- 9220	250	12.5	182.	213.	110488.	5912.	4	AE	.65.
C	22	9260- 9305	45	12.5	186.	217.	86979.	6034.	4	AE	.54.
C	22	9335- 9490	155	12.5	188.	219.	132479.	6118.	4	AE	.75.
C	22	9530- 9600	70	12.5	191.	222.	110945.	6217.	4	AE	.65.
C	22	9700- 9730	30	12.5	194.	225.	95618.	6315.	4	AE	.58.
C	22	9790- 9810	20	12.5	196.	227.	79637.	6370.	4	AE	.50.
C	22	9895-10310	415	12.5	202.	233.	90165.	6567.	4	AE	.55.
C	22	10400-10420	20	12.5	207.	240.	37281.	6766.	4	AE	.19.
C	22	10505-10570	65	12.5	210.	242.	49797.	6849.	4	AE	.30.
C	22	10650-11020	370	12.5	215.	248.	57511.	7043.	4	AE	.36.
C	22	11465-11680	215	12.5	230.	263.	52330.	7522.	4	AE	.33.
C	22	11465-11680	215	12.5	230.	263.	50921.	7522.	4	AE	.32.
C	23	8550- 8680	130	14.8	166.	195.	44910.	6630.	8	HP	.29.
C	23	8770- 8790	20	14.8	168.	197.	65951.	6757.	8	HP	.44.
C	23	8820- 8830	10	14.8	168.	198.	47257.	6792.	8	HP	.31.
C	23	8850- 8970	120	14.8	169.	199.	65980.	6857.	8	HP	.44.
C	23	9030- 9360	330	14.8	173.	203.	111136.	7076.	8	HP	.68.
C	23	9440- 99[illegible]	500	14.8	179.	210.	93157.	7457.	8	HP	.60.
C	23	9970-10230	260	14.8	184.	216.	57161.	7773.	8	HP	.38.
C	23	10280-10430	150	14.8	187.	219.	40392.	7969.	8	HP	.25.
C	23	10445-11500	1055	14.8	195.	228.	77329.	8444.	8	HP	.51.
C	23	11590-11670	80	14.8	[illegible]	236.	36511.	8950.	8	HP	.21.

C	23	11800-12495	695	14.8	210.	243.	55718.	9349.	8	HP	-37.
C	23	12785-12810	25	16.1	224.	257.	22622.	10714.	9	HP	-23.
C	29	7905- 8065	160	11.7	178.	206.	54433.	4858.	1	AE	-44.
C	29	8185- 8240	55	11.7	181.	210.	71192.	4996.	1	AE	-55.
C	29	8290- 8305	15	11.7	182.	211.	46719.	5048.	1	AE	-38.
C	29	8325- 8380	55	11.7	183.	212.	59802.	5082.	1	AE	-48.
C	29	8445- 8590	145	11.7	185.	214.	57339.	5182.	1	AE	-46.
C	29	8660- 8685	25	11.7	187.	217.	46849.	5276.	1	AE	-38.
C	29	8705- 8725	20	11.7	188.	217.	45697.	5302.	1	AE	-37.
C	29	8755- 8775	20	11.7	188.	218.	37451.	5333.	1	AE	-30.
C	29	8930- 8945	15	11.7	190.	221.	50273.	5438.	1	AE	-41.
C	29	8990- 9020	30	11.7	191.	222.	68482.	5479.	1	AE	-53.
C	29	9060- 9115	55	11.7	192.	223.	68525.	5529.	1	AE	-53.
C	29	9180- 9410	230	11.7	195.	226.	56345.	5655.	1	AE	-45.
C	29	9440- 9610	170	11.7	198.	229.	68791.	5795.	1	AE	-53.
C	29	9640- 9675	35	11.7	200.	231.	47285.	5876.	1	AE	-38.
C	29	9720- 9950	230	11.7	202.	234.	43575.	5984.	1	AE	-35.
C	29	9965-10340	375	12.0	213.	245.	47247.	6335.	2	AE	-35.
C	29	10370-10400	30	12.0	215.	247.	20866.	6480.	2	AE	-9.
C	29	10450-10500	50	12.0	217.	249.	20097.	6536.	2	AE	-8.
C	31	8400- 8860	460	10.4	170.	200.	29890.	4667.	1	VC	-53.
C	31	8925- 9220	295	10.4	175.	205.	34181.	4906.	1	VC	-57.
C	31	9280- 9305	25	10.4	178.	208.	22045.	5025.	1	VC	-44.
C	31	9340- 9420	80	10.4	178.	209.	12846.	5073.	1	VC	-30.
C	31	9480- 9770	290	13.7	194.	225.	70223.	6857.	2	L	-47.
C	31	9875- 9900	25	13.7	186.	218.	37419.	7044.	2	L	-23.
C	31	9935-10045	110	13.7	188.	220.	51727.	7117.	2	L	-35.
C	31	10205-10405	200	13.7	193.	225.	49271.	7341.	2	L	-33.
C	31	10445-10535	90	13.7	196.	229.	43614.	7473.	2	L	-28.
C	31	10585-10690	105	13.7	199.	231.	42431.	7578.	2	L	-27.
C	31	10760-10780	20	13.7	201.	233.	36631.	7673.	2	L	-22.
C	31	10835-10955	120	13.7	203.	236.	37617.	7762.	2	L	-23.
C	31	11180-11200	20	13.7	208.	241.	33175.	7972.	2	L	-19.
C	31	11470-11570	100	13.7	213.	246.	45587.	8207.	2	L	-30.
C	31	11620-11650	30	13.7	215.	248.	29522.	8289.	2	L	-16.
C	31	11725-11750	25	13.7	217.	250.	47548.	8362.	2	L	-32.
C	31	11795-11945	150	13.7	219.	252.	41697.	8456.	2	L	-27.
C	31	12045-12085	40	13.7	222.	256.	31531.	8595.	2	L	-18.
C	31	12170-12415	245	13.7	226.	259.	41343.	8757.	2	L	-27.
C	32	7870- 8085	215	11.3	182.	210.	52044.	4688.	2	KP	-65.
C	32	8565- 8645	80	11.3	190.	220.	19947.	5056.	2	KP	-34.
C	32	8680- 8840	160	11.3	192.	222.	33182.	5147.	2	KP	-49.
C	32	8860- 9095	235	11.3	195.	225.	39377.	5275.	2	KP	-55.
C	32	9115- 9540	425	11.3	199.	230.	44538.	5481.	2	KP	-59.
C	32	9560- 9650	90	11.3	203.	234.	13086.	5644.	2	KP	-23.
C	32	9670-10020	350	11.3	205.	237.	45176.	5785.	2	KP	-60.
C	32	10060-10145	85	12.3	209.	241.	23925.	6462.	3	KP	-13.
C	32	10180-10260	80	12.3	210.	242.	37535.	6537.	3	KP	-26.
C	32	10485-10525	40	12.3	214.	246.	24471.	6719.	3	KP	-14.
C	32	10650-10680	30	12.3	216.	248.	25225.	6821.	3	KP	-15.
C	32	10725-10825	100	12.3	217.	250.	30558.	6892.	3	KP	-20.
C	32	10880-10940	60	12.3	219.	252.	23799.	6978.	3	KP	-13.
C	32	10975-11035	60	12.3	220.	253.	33904.	7039.	3	KP	-23.
C	32	11070-11095	25	12.3	221.	254.	32737.	7088.	3	KP	-22.
C	32	11190-11285	95	12.3	223.	256.	32667.	7188.	3	KP	-22.
C	32	11330-11460	130	12.3	225.	258.	21743.	7288.	3	KP	-10.
C	33	7985- 8200	215	11.1	176.	205.	75589.	4671.	2	PL	-62.
C	33	8755- 8790	35	11.1	187.	217.	43291.	5063.	2	PL	-39.
C	33	8805- 8825	20	11.1	187.	217.	26622.	5088.	2	PL	-24.
C	33	8845- 8860	15	11.1	188.	218.	33262.	5110.	2	PL	-30.
C	33	8895- 8925	30	11.1	189.	219.	28442.	5143.	2	PL	-26.
C	33	8955- 8980	25	11.1	190.	220.	48147.	5176.	2	PL	-43.
C	33	9000- 9015	15	11.1	190.	221.	42061.	5199.	2	PL	-38.
C	33	9030- 9050	20	11.1	191.	221.	21503.	5218.	2	PL	-17.
C	33	9080- 9110	30	11.1	192.	222.	44705.	5250.	2	PL	-40.
C	33	9140- 9210	70	11.1	193.	223.	29393.	5296.	2	PL	-27.

C	33	9230- 9290	60	11.1	194.	225.	38538.	5345.	2	PL	.35.
C	33	9340- 9485	145	11.1	197.	228.	36552.	5433.	2	PL	.33.
C	33	9505- 9530	25	11.1	198.	229.	35534.	5494.	2	PL	.32.
C	33	9555- 9690	135	11.1	200.	231.	60530.	5554.	2	PL	.52.
C	33	9760- 9805	45	11.1	202.	234.	32044.	5646.	2	PL	.29.
C	33	9845- 9905	60	11.1	204.	235.	30682.	5700.	2	PL	.28.
C	33	9935-10040	105	11.1	205.	237.	55906.	5765.	2	PL	.49.
C	33	10080-10250	170	11.1	208.	240.	38308.	5867.	2	PL	.35.
C	33	10370-10400	30	11.1	212.	244.	21751.	5994.	2	PL	.18.
C	33	10455-10535	80	12.2	213.	245.	16558.	6658.	3	L	.18.
C	33	10625-10650	25	12.2	215.	248.	17642.	6748.	3	L	.20.
C	33	10985-11015	30	12.2	220.	253.	16444.	6978.	3	L	.18.
C	33	11110-11310	200	12.2	223.	256.	15900.	7112.	3	L	.17.
C	33	11375-11410	35	12.2	226.	259.	20902.	7227.	3	L	.26.
C	33	12010-12035	25	12.2	234.	267.	14674.	7627.	3	L	.15.
C	33	12160-12275	115	13.0	238.	271.	35320.	8259.	4	PL	.14.
C	33	12320-12360	40	13.0	240.	273.	46812.	8342.	4	PL	.25.
C	33	12415-12485	70	13.0	242.	275.	54718.	8416.	4	PL	.32.
C	33	12510-12545	35	13.0	244.	277.	40020.	8469.	4	PL	.19.
C	37	7880- 8085	205	11.3	175.	203.	104267.	4691.	2	H	.45.
C	37	8580- 8655	75	11.6	180.	210.	54087.	5198.	3	H	.25.
C	37	8670- 8905	235	11.6	181.	211.	60974.	5301.	3	H	.30.
C	37	8920- 9270	350	11.6	181.	212.	67782.	5486.	3	H	.34.
C	37	9320- 9460	140	11.6	182.	213.	72325.	5664.	3	H	.37.
C	37	9500- 9550	50	11.6	182.	213.	80605.	5745.	3	H	.43.
C	37	9570- 9790	220	11.6	183.	214.	69407.	5839.	3	H	.35.
C	37	9865- 9890	25	11.6	184.	215.	38781.	5958.	4	H	.12.
C	37	9975-10030	55	11.6	185.	217.	44936.	6034.	4	H	.17.
C	37	10190-10220	30	11.6	188.	220.	42545.	6156.	4	H	.15.
C	37	10250-10290	40	11.6	188.	221.	39921.	6195.	4	H	.13.
C	37	10490-10540	50	11.8	194.	226.	35788.	6452.	5	H	.11.
C	37	10635-10700	65	11.8	196.	229.	37963.	6546.	6	H	.14.
C	37	10990-11060	70	11.8	205.	237.	38139.	6765.	6	H	.14.
C	37	11085-11105	20	11.8	206.	239.	37051.	6808.	6	H	.13.
C	77	7920- 8720	800	11.1	163.	192.	82647.	4802.	2	HP	.48.
C	77	8755- 8785	30	11.8	170.	200.	53287.	5381.	3	HP	.29.
C	77	8805- 8910	105	11.8	171.	201.	48003.	5435.	3	HP	.25.
C	77	8935- 8985	50	11.8	172.	202.	44553.	5498.	3	HP	.22.
C	77	9020- 9180	160	11.8	173.	203.	51874.	5564.	3	HP	.28.
C	77	9275- 9395	120	11.8	175.	205.	48137.	5728.	3	HP	.25.
C	77	9535- 9615	80	12.0	181.	213.	39298.	5975.	4	HP	.20.
C	77	9630- 9690	60	12.0	178.	210.	39257.	6028.	4	HP	.20.
C	77	9720- 9780	60	12.0	180.	212.	32981.	6064.	4	HP	.14.
C	77	9860- 9920	60	12.0	183.	215.	40387.	61[illegible]1.	4	HP	.21.
C	77	9960- 9995	35	12.0	185.	217.	33109.	62[illegible]6.	4	HP	.14.
C	77	10030-10220	190	12.2	188.	220.	47221.	6[illegible]23.	5	HP	.22.
C	77	10250-10610	360	12.2	194.	226.	39968.	66[illegible]7.	5	HP	.16.
C	118	7680- 8045	365	13.6	195.	222.	117339.	5550.	1	PGA	.41.
C	118	8065- 8135	70	13.6	198.	227.	95803.	5728.	1	PGA	.31.
C	118	8190- 8240	50	13.6	200.	229.	88506.	5810.	1	PGA	.27.
C	118	8290- 8410	120	13.6	202.	231.	77170.	5905.	1	PGA	.21.
C	118	8960- 9040	80	13.6	212.	242.	62908.	6365.	1	PGA	.12.
C	118	9690- 9790	100	13.6	223.	255.	62163.	6888.	1	PGA	.12.
C	118	9840- 9900	60	13.6	225.	257.	59134.	6980.	1	PGA	.10.
C	118	13655-13835	180	15.7	277.	309.	53731.	11221.	5	PGA	.17.
C	124	7990- 8010	20	10.0	182.	210.	20896.	4160.	1	AB	.40.
C	124	8445- 8475	30	10.0	188.	217.	8625.	4399.	1	AB	.19.
C	124	8570- 8595	25	10.0	190.	219.	10143.	4463.	1	AB	.23.
C	124	8605- 8630	25	10.0	190.	220.	30379.	4481.	1	AB	.52.
C	124	8655- 8730	75	10.0	191.	221.	16735.	4520.	1	AB	.34.
C	124	8750- 8820	70	10.0	192.	222.	30283.	4568.	1	AB	.52.
C	124	8840- 8880	40	10.0	193.	223.	26166.	4607.	1	AB	.48.
C	124	8930- 9045	115	10.0	195.	225.	34115.	4673.	1	AB	.55.
C	145	7805- 8200	395	10.4	165.	193.	62219.	4328.	1	CT	.70.
C	145	8260- 8520	260	10.4	169.	198.	86026.	4537.	1	CT	.85.
C	145	8640- 8655	15	10.4	172.	201.	40801.	4677.	1	CT	.54.

C	145	8750• 8840	90	10•4	174•	203•	50149•	4756•	1	CT	•62•
C	145	8880• 8950	70	10•4	175•	205•	45655•	4821•	1	CT	•58•
C	165	7755• 8020	265	10•0	167•	195•	35394•	4101•	1	OP	•57•
C	165	8040• 8320	280	10•0	170•	199•	56679•	4254•	1	OP	•75•
C	165	8340• 8510	170	10•0	173•	202•	98324•	4381•	1	OP	•100•
C	177	7800• 8050	250	11•6	176•	204•	78906•	4780•	1	AB	•69•
C	177	8155• 8265	110	11•6	180•	208•	160649•	4952•	1	AB	•105•
C	177	8295• 8360	65	11•6	181•	210•	117808•	5023•	1	AB	•87•
C	177	8390• 8405	15	11•6	182•	211•	62644•	5065•	1	AB	•58•
C	177	8490• 8525	35	11•6	184•	213•	66042•	5132•	1	AB	•60•
C	177	8555• 8575	20	11•6	184•	214•	69200•	5166•	1	AB	•52•
C	177	8735• 8755	20	11•6	187•	216•	34984•	5275•	1	AB	•36•
C	177	8900• 8920	20	11•6	189•	219•	48621•	5375•	1	AB	•48•
C	177	8940• 8955	15	11•6	189•	219•	64440•	5397•	1	AB	•59•
C	177	8985• 9125	140	11•6	191•	221•	96342•	5462•	1	AB	•78•
C	177	9220• 9440	220	11•6	194•	225•	91339•	5628•	1	AB	•75•
C	177	9480• 9710	230	11•6	198•	229•	134334•	5788•	1	AB	•95•
C	177	9760•10010	250	11•6	201•	233•	54189•	5963•	1	AB	•52•
C	177	10030•10490	460	11•6	206•	238•	29749•	6189•	1	AB	•32•
C	177	10560•10850	290	11•6	212•	244•	19335•	6457•	1	AB	•19•
C	177	15320•15467	147	15•3	291•	320•	13848•	12247•	3	B	11•
C	183	8015• 8225	210	12•4	178•	207•	33844•	5236•	2	XO	•54•
C	183	8775• 9100	325	12•4	190•	220•	22930•	5763•	2	XO	•43•
C	183	9150• 9250	100	12•4	194•	224•	22117•	5932•	2	XO	•42•
C	183	9310• 9450	140	12•4	196•	227•	28136•	6048•	2	XO	•50•
C	183	9495• 9540	45	12•4	198•	229•	20510•	6137•	2	XO	•40•
C	183	9580• 9640	60	12•4	200•	231•	13697•	6197•	2	XO	•29•
C	183	9665• 9770	105	12•4	201•	233•	35072•	6266•	2	XO	•56•
C	183	9830• 9890	60	12•4	203•	235•	17865•	6358•	2	XO	•36•
C	183	9940•10000	60	12•4	205•	237•	15505•	6429•	2	XO	•32•
C	183	10130•10160	30	12•4	207•	239•	9312•	6541•	2	XO	•21•
C	183	10195•10270	75	12•4	209•	241•	9305•	6598•	2	XO	•21•
C	183	11020•11080	60	12•4	220•	253•	8523•	7125•	2	XO	•19•
C	183	11950•12010	60	12•4	233•	267•	8112•	7725•	2	XO	•18•
C	183	12080•12100	20	15•4	235•	268•	53954•	9682•	3	XO	•36•
C	183	12160•12220	60	15•4	236•	269•	45897•	9762•	3	XO	•29•
C	183	12360•12410	50	15•4	239•	272•	40101•	9918•	3	XO	•24•
C	183	12490•12515	25	15•4	240•	273•	45679•	10012•	3	XO	•29•
C	183	12540•12575	35	15•4	241•	274•	38189•	10056•	3	XO	•22•
C	183	12620•12710	90	15•4	242•	275•	39064•	10142•	3	XO	•23•
C	183	12775•12830	55	15•4	244•	277•	38092•	10252•	3	XO	•22•
C	183	12860•12915	55	15•4	245•	278•	40978•	10320•	3	XO	•25•
C	183	13000•13100	100	15•4	247•	280•	40870•	10450•	3	XO	•25•
C	183	13155•13195	40	15•4	249•	282•	40786•	10551•	3	XO	•25•
C	183	13230•13310	80	15•4	250•	283•	36969•	10627•	3	XO	•21•
C	183	13380•13450	70	15•4	252•	285•	36936•	10743•	3	XO	•21•
C	183	13580•13605	25	15•4	254•	287•	33896•	10885•	3	XO	•18•
C	183	13630•13720	90	15•4	255•	288•	35918•	10951•	3	XO	•20•
C	183	13850•13930	80	15•4	258•	290•	34885•	11123•	3	XO	•19•
C	183	14285•14315	30	15•4	263•	295•	37633•	11451•	3	XO	•22•
C	183	14470•14525	55	15•4	266•	297•	39313•	11610•	3	XO	•24•
C	183	16280•17930	1650	16•4	305•	328•	1802•	14587•	4	XO	38•
C	183	18090•18150	60	16•4	318•	336•	14522•	15453•	4	XO	•10•
C	186	8025• 8065	40	10•2	169•	197•	28182•	4267•	1	K	•55•
C	186	8515• 8575	60	10•2	175•	204•	27759•	4532•	1	K	•55•
C	186	8620• 8810	190	10•2	177•	206•	27613•	4622•	1	K	•55•
C	186	8835• 8900	65	10•2	178•	208•	27481•	4703•	1	K	•55•
C	186	8910• 8960	50	10•2	179•	209•	31366•	4739•	1	K	•59•
C	186	8970• 9000	30	10•2	180•	210•	7710•	4766•	1	K	•23•
W	2	8245• 8375	130	10•2	160•	188•	43352•	4408•	4	B	•62•
W	2	8440• 8520	80	10•2	163•	192•	35870•	4498•	4	B	•55•
W	2	8585• 8705	120	10•7	166•	195•	57195•	4810•	5	B	•65•
W	2	8765• 9100	335	10•7	172•	202•	61219•	4970•	5	B	•68•
W	2	9180• 9190	10	10•7	177•	208•	38252•	5111•	5	B	•50•
W	2	9275• 9350	75	10•7	180•	210•	64517•	5181•	5	B	•70•
W	2	9385• 9425	40	10•7	181•	212•	29175•	5233•	5	B	•42•

W	2	9460• 9820	360	10.7	186.	217.	64395.	5364.	5	0	.70.
W	2	9850• 9870	20	10.7	190.	222.	56793.	5486.	5	0	.65.
W	2	9890•10460	570	11.5	183.	215.	83118.	6085.	6	0	.55.
W	2	10560•10700	140	11.5	192.	224.	58811.	6357.	6	0	.39.
W	2	10720•10760	40	11.5	192.	225.	51910.	6423.	6	0	.34.
W	2	10810•10840	30	11.5	192.	225.	54855.	6473.	6	0	.36.
W	2	10890•11040	150	11.5	192.	223.	60050.	6557.	6	0	.40.
W	2	11070•11480	410	11.4	217.	250.	64099.	6684.	7	0	.50.
W	2	11525•11800	275	11.8	225.	258.	77556.	7156.	8	0	.50.
W	2	11840•12010	170	11.8	226.	259.	60425.	7317.	9	I	.40.
W	2	12110•12380	270	11.8	230.	263.	120802.	7514.	9	I	.76.
W	2	12610•12920	310	12.3	230.	263.	56175.	8164.	10	0	.75.
W	2	12960•13010	50	12.4	225.	258.	47154.	8373.	11	0	.60.
W	2	13070•13225	155	12.4	226.	259.	59037.	8478.	11	0	.70.
W	2	13270•13300	30	12.4	223.	256.	67345.	8566.	11	0	.75.
W	2	13375•13427	52	12.4	221.	253.	67937.	8641.	11	0	.75.
W	3	8011• 8045	34	10.3	166.	195.	18479.	4300.	5	0I	.32.
W	3	8070• 8305	235	10.3	171.	200.	50999.	4385.	5	0I	.65.
W	3	8330• 8350	20	10.3	175.	204.	36214.	4467.	5	0I	.52.
W	3	8380• 8550	170	10.3	179.	208.	50799.	4534.	5	0I	.65.
W	3	8575• 8605	30	10.3	183.	212.	33645.	4601.	5	0I	.50.
W	3	8620• 8750	130	10.8	181.	211.	53547.	4877.	6	0	.70.
W	3	8845• 8870	25	10.8	188.	218.	43268.	4974.	6	0	.62.
W	3	8910• 9040	130	10.8	190.	220.	40539.	5040.	6	0	.60.
W	3	9065• 9100	35	10.8	192.	222.	56106.	5101.	6	0	.72.
W	3	9125• 9150	25	10.8	193.	223.	40476.	5132.	6	0	.60.
W	3	9195• 9215	20	10.8	194.	224.	24556.	5170.	6	0	.45.
W	3	9260• 9330	70	10.8	195.	226.	53215.	5220.	6	0	.70.
W	3	9350• 9555	205	11.0	197.	228.	67076.	5407.	7	0I	.77.
W	3	9585• 9660	75	11.0	198.	230.	36408.	5504.	7	0I	.54.
W	3	9705• 9855	150	11.0	200.	231.	26050.	5594.	7	0I	.45.
W	3	9880•10010	130	11.0	201.	233.	41998.	5689.	7	0I	.59.
W	3	10035•10120	85	11.1	206.	238.	22078.	5817.	8	0I	.65.
W	3	10150•10275	125	11.1	205.	237.	11768.	5895.	8	0I	.48.
W	3	10380•10395	15	11.1	208.	241.	7175.	5996.	8	0I	.37.
W	3	10430•10460	30	11.1	209.	242.	5127.	6029.	8	0I	.30.
W	3	10510•10815	305	11.4	217.	249.	10545.	6321.	9	0	.45.
W	3	10860•11130	270	11.4	223.	255.	9127.	6518.	9	0	.42.
W	3	11160•11290	130	11.4	230.	263.	6730.	6654.	9	0	.35.
W	3	11360•11400	40	11.4	236.	269.	9861.	6746.	10	I	.37.
W	3	11425•11645	220	11.4	249.	282.	11591.	6838.	10	I	.41.
W	3	11675•11690	15	11.4	261.	294.	8569.	6925.	10	I	.34.
W	3	11720•12230	510	11.9	265.	298.	18884.	7410.	11	I	.55.
W	3	12275•12498	223	11.9	286.	319.	24855.	7665.	12	I	.68.
W	5	8155• 8565	410	10.8	173.	202.	54858.	4695.	4	AH	.65.
W	5	8595• 8775	180	10.8	175.	205.	54812.	4877.	4	AH	.65.
W	5	8840• 9090	250	10.8	177.	207.	54777.	5035.	4	AH	.65.
W	5	9155• 9490	335	10.7	179.	210.	115265.	5187.	5	AG	.65.
W	5	9550•10002	452	10.7	182.	214.	115355.	5439.	5	AG	.65.
W	31	8010• 8040	30	10.8	161.	189.	21534.	4507.	4	I	.50.
W	31	8060• 8080	20	10.8	157.	185.	18121.	4532.	4	I	.45.
W	31	8190• 8275	85	10.8	160.	188.	14920.	4623.	4	I	.40.
W	31	8485• 8510	25	10.8	165.	194.	48657.	4772.	4	I	.77.
W	31	9035• 9055	20	11.0	176.	207.	11141.	5174.	5	I	.28.
W	31	9095• 9105	10	11.0	178.	209.	11119.	5205.	5	I	.28.
W	31	9160• 9200	40	11.0	181.	211.	30151.	5251.	5	I	.55.
W	31	9365• 9380	15	11.0	187.	218.	25019.	5361.	5	I	.50.
W	31	9420• 9475	55	11.0	188.	219.	40199.	5404.	6	I	.55.
W	31	9500• 9550	50	11.0	188.	219.	24591.	5448.	6	I	.40.
W	31	9580• 9630	50	11.0	188.	219.	21266.	5494.	6	I	.35.
W	31	9685• 9735	50	11.0	188.	220.	21263.	5554.	6	I	.35.
W	31	9755• 9940	185	11.0	189.	220.	23974.	5633.	6	I	.39.
W	31	9980•10095	115	11.0	189.	221.	21980.	5741.	6	I	.36.
W	31	10155•10195	40	11.3	194.	226.	25010.	5979.	7	I0	.42.
W	31	10230•10310	80	11.3	190.	222.	23978.	6035.	7	I0	.40.
W	31	10350•10370	20	11.3	192.	224.	20489.	6088.	7	I0	.35.

W	31	10510-10560	50	11.3	194.	227.	33994.	6190.	7	IO	.50.
W	31	10580-10630	50	11.3	195.	228.	23816.	6231.	7	IO	.40.
W	31	10665-10910	245	11.3	198.	231.	23102.	6339.	7	IO	.39.
W	31	10940-10980	40	11.3	200.	233.	45414.	6440.	7	IO	.60.
W	31	11110-11120	10	12.1	203.	236.	37893.	6994.	8	I	.38.
W	31	11160-11190	30	12.1	204.	237.	43980.	7031.	8	I	.43.
W	33	8020- 8055	35	10.4	175.	203.	82913.	4347.	2	H	.50.
W	33	8110- 8180	70	10.4	176.	204.	72491.	4405.	2	H	.43.
W	33	8220- 8245	25	10.4	177.	205.	49839.	4452.	2	H	.28.
W	33	8350- 8410	60	10.4	178.	207.	55855.	4532.	2	H	.32.
W	33	8580- 8605	25	10.4	180.	210.	75498.	4647.	2	H	.45.
W	33	8645- 8660	15	10.4	181.	210.	40476.	4679.	2	H	.20.
W	33	9490- 9510	20	11.6	182.	213.	29904.	5730.	3	H	.20.
W	33	9550- 9570	20	11.6	182.	213.	36003.	5767.	3	H	.25.
W	33	9595- 9710	115	11.4	183.	214.	58692.	5722.	4	H	.54.
W	33	9765- 9800	35	11.4	185.	216.	28512.	5799.	4	H	.29.
W	33	9830- 9950	120	11.4	186.	218.	63503.	5863.	4	H	.57.
C	4	7780- 8040	260	11.1	165.	193	55864.	4566.	5	I	.65.
C	4	8085- 8370	285	11.1	166.	195.	97393.	4749.	5	I	.90.
C	4	8390- 8685	295	11.0	168.	197.	42286.	4883.	6	O	.67.
C	4	8720- 8825	105	11.0	169.	199.	25367.	5018.	6	O	.51.
C	4	8855- 8890	35	11.0	169.	199.	29330.	5075.	6	O	.55.
C	4	8910- 8940	30	11.0	170.	200.	28396.	5105.	6	O	.54.
C	4	9135- 9280	145	11.7	176.	206.	46975.	5602.	7	O	.70.
C	4	8975- 9110	135	11.7	178.	208.	60033.	5501.	7	O	.80.
C	4	9300- 9590	290	11.5	180.	211.	58577.	5648.	8	O	.20.
W	46	7750- 8650	900	12.0	162.	191.	77284.	5117.	2	EP	.42.
W	46	8720- 8760	40	12.0	167.	197.	59110.	5454.	2	EP	.30.
W	46	8880- 9370	490	12.0	171.	201.	59239.	5694.	2	EP	.30.
W	46	9400- 9510	110	14.0	189.	220.	77937.	6883.	3	EP	.33.
W	46	9565- 9635	70	14.0	176.	208.	59912.	6989.	3	EP	.22.
W	46	9925-10070	145	14.0	183.	215.	70391.	7278.	3	EP	.28.
W	46	10150-10270	120	14.0	186.	218.	76368.	7433.	3	EP	.32.
W	46	10800-11050	250	14.0	198.	231.	57864.	7953.	3	EP	.19.
W	46	11470-11650	180	14.0	208.	241.	65121.	8416.	3	EP	.24.
W	46	11740-11945	205	14.0	213.	246.	72269.	8621.	3	EP	.29.
W	46	12155-12450	295	14.0	220.	254.	70035.	8956.	3	EP	.28.
W	73	8035- 8125	90	11.3	167.	195.	68591.	4748.	1	E	.35.
W	73	8165- 8185	20	11.3	168.	197.	60108.	4804.	1	E	.30.
W	73	8220- 8280	60	11.3	169.	198.	63741.	4848.	1	E	.32.
W	73	8340- 8430	90	11.3	170.	199.	83906.	4927.	1	E	.45.
W	73	8560- 8635	75	11.3	173.	202.	74621.	5052.	1	E	.39.
W	73	8695- 8800	105	11.3	175.	204.	70419.	5140.	1	E	.36.
W	73	8830- 8890	60	11.3	176.	206.	60581.	5206.	1	E	.30.
W	73	8930- 9275	345	11.3	179.	209.	73518.	5349.	1	E	.35.
W	73	9575- 9670	95	11.3	185.	216.	64728.	5654.	1	E	.32.
W	73	9785- 9950	165	11.3	187.	219.	59783.	5798.	1	E	.29.
W	73	10005-10080	75	11.3	189.	221.	54706.	5901.	1	E	.25.
W	73	10120-10230	110	11.3	191.	223.	61821.	5979.	1	E	.30.
W	73	10275-10405	130	11.3	193.	225.	65432.	6076.	1	E	.32.
W	73	10435-10910	475	15.2	209.	242.	113935.	8436.	2	E	.55.
W	73	10990-11020	30	15.2	204.	237.	64313.	8698.	2	E	.27.
W	73	11110-11500	390	15.2	209.	242.	104569.	8935.	2	E	.51.
W	73	11550-11900	350	15.2	217.	250.	61221.	9267.	2	E	.26.
W	73	11930-12090	160	15.2	222.	255.	74108.	9493.	2	E	.35.
W	73	12205-12300	95	15.2	227.	260.	72252.	9684.	2	E	.34.
W	73	12480-12610	130	15.2	232.	265.	72898.	9916.	2	E	.35.
W	73	12650-12715	65	15.1	234.	267.	24355.	9958.	3	EP	.33.
W	73	12760-12870	110	15.1	237.	270.	25923.	10062.	3	EP	.35.
W	73	13010-13120	110	15.1	241.	274.	17658.	10259.	3	EP	.23.
W	73	13660-13710	50	15.1	252.	285.	20361.	10745.	3	EP	.28.
W	73	15060-15180	120	17.7	294.	324.	22111.	13916.	5	E	.23.
W	73	15250-15350	100	17.7	296.	326.	19569.	14082.	5	E	.19.
W	73	15410-15560	150	17.7	299.	328.	21407.	14252.	5	E	.22.
W	73	15590-15660	70	17.7	300.	329.	19997.	14381.	5	E	.20.
W	78	7820- 8040	220	11.1	173.	201.	100117.	4577.	1	P	.55.

W	78	8115.	8270	155	11.1	177.	205.	113314.	4729.	1	P	.60.
W	78	8330.	8345	15	11.1	178.	207.	73639.	4812.	1	P	.40.
W	78	8370.	8415	45	11.1	179.	208.	100558.	4844.	1	P	.55.
W	78	8450.	8630	180	11.1	181.	210.	113479.	4929.	1	P	.60.
W	78	8660.	8685	25	11.1	182.	212.	91353.	5006.	1	P	.50.
W	78	8720.	8840	120	11.1	184.	214.	128537.	5068.	1	P	.67.
W	78	8880.	8935	55	11.1	185.	215.	101173.	5141.	1	P	.55.
W	78	9010.	9110	100	11.8	175.	205.	88205.	5559.	2	P	.57.
W	78	9185.	9340	155	11.8	188.	218.	105659.	5683.	2	P	.65.
W	78	9480.	9510	30	11.8	188.	219.	61000.	5826.	2	P	.40.
W	78	9650.	9665	15	11.8	189.	220.	61028.	5926.	2	P	.40.
W	78	9755.	10210	455	11.8	190.	221.	105788.	6125.	2	P	.65.
W	78	10255.	10500	245	11.8	191.	223.	64643.	6368.	2	P	.42.
W	82	7930.	8000	70	11.0	172.	200.	46996.	4556.	3	AE	.31.
W	82	8175.	8300	125	11.0	175.	204.	47079.	4712.	3	AE	.31.
W	82	8380.	8405	25	11.0	176.	205.	34854.	4801.	3	AE	.20.
W	82	8465.	8565	100	11.0	178.	207.	39799.	4871.	3	AE	.25.
W	82	8610.	8625	15	11.0	178.	208.	42324.	4929.	3	AE	.27.
W	82	8780.	8960	180	11.0	181.	211.	39832.	5074.	3	AE	.25.
W	82	9025.	9080	55	12.8	184.	214.	50681.	6025.	4	PE	.23.
W	82	9195.	9305	110	12.8	191.	221.	54235.	6157.	4	PE	.25.
W	82	9380.	9390	10	12.8	195.	226.	50055.	6247.	4	PE	.22.
W	82	9780.	10055	275	12.8	213.	244.	74457.	6601.	4	PE	.39.
W	82	10150.	10540	390	13.2	222.	254.	64412.	7101.	5	AE	.21.
W	82	10720.	10860	140	14.2	231.	263.	90857.	7967.	6	AEP	.21.
W	82	10895.	11095	200	14.2	232.	265.	88910.	8119.	6	AEP	.20.
W	82	11180.	11225	45	14.2	237.	270.	86366.	8272.	6	AEP	.19.
W	83	8015.	8050	35	11.1	153.	182.	65879.	4636.	5	P	.59.
W	83	8150.	8190	40	11.1	156.	184.	57745.	4716.	5	P	.54.
W	83	8320.	8400	80	11.1	160.	188.	67292.	4825.	5	P	.60.
W	83	8450.	8505	55	11.1	162.	191.	62100.	4893.	5	P	.57.
W	83	8595.	8625	30	11.1	164.	194.	77212.	4970.	5	P	.67.
W	83	8675.	8700	25	11.1	166.	195.	32764.	5014.	5	P	.33.
W	83	8750.	9050	300	12.5	166.	196.	105330.	5785.	6	P	.70.
W	83	9090.	9120	30	12.5	172.	202.	94252.	5918.	6	P	.65.
W	83	9155.	9390	235	12.5	174.	204.	105234.	6027.	6	P	.70.
W	83	9450.	9490	40	12.5	176.	207.	94362.	6155.	6	P	.65.
W	83	9535.	9670	135	12.5	177.	209.	84204.	6242.	6	P	.60.
W	83	9780.	9980	200	12.5	181.	212.	84359.	6422.	6	P	.60.
W	83	10125.	10240	115	12.5	184.	216.	34608.	6619.	7	P	.30.
W	83	11170.	11190	20	11.0	194.	226.	14402.	6395.	9	P	.25.
W	83	11235.	11250	15	11.0	196.	229.	14399.	6431.	9	P	.25.
W	83	11940.	12005	65	16.5	239.	273.	27878.	10272.	11	HX	.25.
W	83	12070.	12145	75	16.6	241.	274.	29056.	10451.	12	HX	.23.
W	83	12330.	12350	20	16.6	243.	276.	29863.	10652.	12	HX	.24.
W	84	8200.	8300	100	11.5	166.	194.	49347.	4933.	1	G	.50.
W	84	8490.	8505	15	11.5	168.	197.	27671.	5082.	1	G	.30.
W	84	8570.	8695	125	11.5	170.	199.	88472.	5162.	1	G	.75.
W	84	8950.	8985	35	11.5	173.	204.	25412.	5363.	1	G	.28.
W	84	9200.	9275	75	11.5	176.	207.	25304.	5524.	1	G	.28.
W	84	9340.	9380	40	11.5	178.	209.	23244.	5597.	1	G	.25.
W	84	9530.	9580	50	11.5	180.	211.	19560.	5714.	1	G	.20.
W	84	9720.	9825	105	11.5	182.	214.	32307.	5844.	1	G	.35.
W	84	9885.	9990	105	11.5	184.	216.	28819.	5943.	1	G	.32.
W	84	10010.	10023	13	11.5	185.	217.	16336.	5990.	1	G	.15.
W	90	8015.	8035	20	12.5	171.	199.	22911.	5216.	2	P	.26.
W	90	8100.	8110	10	12.5	172.	200.	21396.	5268.	2	P	.24.
W	90	8140.	8150	10	12.5	172.	201.	29687.	5294.	2	P	.34.
W	90	8190.	8230	40	12.5	173.	201.	61203.	5336.	2	P	.60.
W	90	8295.	8390	95	12.5	174.	203.	29587.	5423.	2	P	.34.
W	90	9430.	9570	140	12.5	186.	217.	41430.	6175.	2	P	.45.
W	90	9730.	9840	110	12.5	189.	220.	27100.	6360.	2	P	.32.
W	90	9900.	10195	295	12.5	191.	223.	25075.	6531.	2	P	.30.
W	90	10295.	10695	400	15.6	211.	243.	68220.	8514.	3	GJ	.50.
W	90	10710.	11120	410	15.6	204.	237.	126184.	8854.	3	GJ	.80.
W	90	11170.	11560	390	15.6	213.	246.	112167.	9219.	3	GJ	.75.

W	90	11600•11950	350	15.6	221.	254.	61773.	9552.	3	GJ	.47.
W	90	12160•12210	50	15.6	229.	262.	58083.	9884.	3	GJ	.45.
W	90	12240•12350	110	15.6	231.	264.	51423.	9974.	3	GU	.40.
W	90	12420•12445	25	15.6	233.	266.	70242.	10085.	3	GU	.54.
W	90	12600•13275	675	15.7	246.	278.	69929.	10562.	4	GU	.56.
W	90	13475•13520	45	15.7	259.	292.	54360.	11019.	4	GU	.45.
W	90	13610•13690	80	16.1	259.	292.	21140.	11428.	5	GU	.35.
W	90	13750•13930	180	16.1	259.	291.	24395.	11587.	5	GU	.40.
W	90	14520•14560	40	17.3	261.	292.	23563.	13080.	6	U	.32.
W	90	14600•15050	450	17.3	270.	301.	24579.	13337.	6	U	.34.
W	90	15140•16000	860	17.3	294.	323.	24750.	14007.	6	U	.35.
W	92	7550• 8210	660	12.0	163.	190.	121715.	4917.	1	H	.63.
W	92	8320• 8345	25	12.0	168.	196.	71167.	5199.	1	H	.38.
W	92	8435• 8535	100	12.0	169.	198.	106945.	5295.	1	H	.57.
W	92	8565• 8595	30	12.0	170.	200.	83228.	5354.	1	H	.46.
W	92	8620• 8650	30	12.0	171.	200.	8[illegible]266.	5388.	1	H	.46.
W	92	8690• 9320	630	12.0	175.	205.	99407.	5619.	1	H	.54.
W	92	9395• 9850	455	12.0	182.	213.	73248.	6004.	1	H	.39.
W	92	9910•10110	200	13.2	186.	218.	74999.	6871.	2	H	.33.
W	92	10170•10455	285	13.2	190.	222.	61256.	7078.	2	H	.24.
W	92	10555•10660	105	13.2	194.	226.	51755.	7281.	2	H	.17.
W	92	10710•10765	55	13.2	195.	228.	47018.	7370.	2	H	.13.
W	93	8125• 8160	35	10.6	173.	202.	31013.	4488.	5	I	.52.
W	93	8205• 8220	15	10.5	180.	209.	17911.	4527.	5	I	.36.
W	93	8330• 8350	20	10.6	193.	222.	27682.	4597.	5	I	.50.
W	93	8560• 8625	65	10.6	219.	248.	61227.	4736.	5	I	.80.
W	93	8700• 8810	110	11.2	171.	201.	87730.	5099.	7	0	.95.
W	93	8900• 9240	340	11.2	230.	260.	76479.	5282.	7	0	.95.
W	93	9330• 9490	160	11.2	218.	248.	46053.	5480.	7	0	.70.
W	93	9650• 9710	60	11.2	208.	239.	13640.	5638.	7	0	.32.
W	93	9825•10350	525	11.5	226.	258.	16300.	6032.	9	0	.42.
W	93	10470•11085	615	11.5	208.	241.	18801.	6445.	9	0	.45.
W	93	11085•11207	122	11.7	209.	242.	38728.	6781.	10	0	.65.
W	101	8120• 8140	20	10.6	169.	198.	48706.	4481.	3	H	.38.
W	101	8190• 8280	90	10.6	169.	198.	41673.	4539.	3	H	.32.
W	101	8390• 8450	60	.6	170.	199.	62897.	263.	3	H	.50.
W	101	8530• 8580	50	11.0	172.	201.	74505.	4893.	4	H	.60.
W	101	8730• 9050	320	11.0	179.	209.	88275.	5085.	4	H	.68.
W	101	9135• 9330	195	11.0	187.	217.	67342.	5281.	4	H	.55.
W	101	9425• 9620	195	11.9	192.	223.	73379.	5893.	5	H	.42.
W	101	9660• 9800	140	11.9	196.	227.	76439.	6021.	5	H	.44.
W	101	9910•10230	320	11.9	201.	233.	77945.	6231.	5	H	.45.
W	101	10320•10470	150	11.9	207.	239.	73132.	6432.	5	H	.42.
W	101	10505•10705	200	13.3	213.	246.	74937.	7334.	6	H	.38.
W	101	10980•11050	70	13.3	219.	252.	54242.	7618.	6	H	.24.
W	101	11080•11145	65	13.3	221.	254.	62045.	7685.	6	H	.30.
W	101	11210•11300	90	13.3	224.	257.	69431.	7784.	6	H	.35.
W	101	11675•11700	25	13.3	233.	266.	58235.	8083.	6	H	.28.
W	101	11755•11795	40	13.3	235.	268.	53214.	8144.	6	H	.24.
W	101	11925•12005	80	13.3	239.	272.	79744.	8275.	6	H	.45.
W	102	8250• 8285	35	10.7	177.	206.	22903.	4600.	2	P	.37.
W	102	8325• 8350	25	10.7	178.	207.	17906.	4639.	2	P	.30.
W	102	8370• 8385	15	10.7	178.	207.	11762.	4661.	2	P	.20.
W	102	8590• 8605	15	10.7	181.	211.	15381.	4784.	2	P	.26.
W	102	8660• 8680	20	10.7	182.	212.	14735.	4824.	2	P	.25.
W	102	8815• 8920	105	10.7	185.	214.	23379.	4934.	2	P	.38.
W	102	8980• 9015	35	10.7	186.	216.	20449.	5006.	2	P	.34.
W	102	9035• 9095	60	10.7	187.	217.	19133.	5044.	2	P	.32.
W	102	9130• 9290	160	10.7	189.	219.	26122.	5124.	2	P	.42.
W	102	9345• 9440	95	10.7	191.	222.	22526.	5226.	2	P	.37.
W	102	9485• 9500	15	10.7	192.	223.	21070.	5282.	2	P	.33.
W	102	9685• 9735	50	10.7	195.	226.	16517.	5403.	2	P	.28.
W	102	9785• 9900	115	10.7	196.	228.	21675.	5476.	2	P	.36.
W	102	10510•10740	230	10.8	215.	247.	51015.	5967.	4	P	.60.
W	102	10760•10785	25	10.8	214.	247.	39464.	6050.	4	P	.50.
W	102	10860•11135	275	10.8	225.	253.	[illegible]6984.	6176.	4	P	.65.

W	102	11205-11280	75	10.8	227.	260.	25832.	6314.	4	P	.38.
W	102	11340-11490	150	10.8	232.	265.	25613.	6411.	4	P	.38.
W	102	11570-11700	130	10.8	238.	271.	27261.	6534.	4	P	.40.
W	102	11730-12100	370	10.8	246.	279.	65863.	6691.	4	P	.75.
W	102	12190-12480	290	10.8	257.	290.	31182.	6927.	4	P	.45.
W	103	7995- 8005	10	11.0	171.	199.	26673.	4576.	1	D	.40.
W	103	8075- 8090	15	11.0	172.	200.	37223.	4623.	1	D	.50.
W	103	8110- 8215	105	11.0	173.	201.	37183.	4669.	1	O	.50.
W	103	8270- 8300	30	11.0	174.	203.	42393.	4739.	1	O	.55.
W	103	8330- 8340	10	11.0	175.	204.	19599.	4768.	1	D	.31.
W	103	8400- 8465	65	11.0	176.	205.	46042.	4823.	1	D	.58.
W	103	8500- 8675	175	11.0	178.	207.	55139.	4912.	1	D	.65.
W	103	8705- 8950	245	11.0	181.	211.	62216.	5049.	1	D	.70.
W	103	9020- 9170	145	11.0	184.	214.	25965.	5204.	1	D	.40.
W	103	9260- 9310	50	11.0	186.	217.	45954.	5311.	1	O	.58.
W	103	9395- 9490	95	11.0	188.	219.	30684.	5401.	1	D	.45.
W	103	9530- 9665	135	11.0	190.	221.	45934.	5490.	1	D	.58.
W	103	9690- 9825	135	11.0	192.	223.	54963.	5581.	1	D	.65.
W	103	9900- 9950	50	12.5	198.	230.	37348.	6451.	2	D	.40.
W	103	9970-10170	200	12.5	196.	228.	29215.	6545.	2	O	.33.
W	103	10190-10550	360	12.5	202.	234.	31760.	6740.	2	D	.35.
W	103	10805-10840	35	16.4	212.	244.	64375.	9229.	4	DKP	.35.
W	103	11100-11115	15	16.4	220.	252.	55044.	9472.	4	DKP	.29.
W	103	11670-11740	70	16.4	236.	269.	60952.	9962.	4	OKP	.35.
W	103	11920-12000	80	16.4	243.	276.	59969.	10199.	4	OKP	.35.
W	103	12075-12095	20	16.4	247.	280.	58596.	10306.	4	OKP	.34.
W	103	12315-12340	25	16.4	253.	286.	55871.	10513.	4	DKP	.32.
W	103	12820-13005	185	16.8	262.	295.	56034.	11280.	5	DKP	.30.
W	111	7810- 8035	225	10.8	151.	179.	31247.	4449.	2	B	.50.
W	111	8105- 8270	165	10.8	153.	182.	38515.	4598.	2	B	.57.
W	111	8370- 8410	40	10.8	155.	184.	18792.	4712.	2	B	.36.
W	111	8495- 8625	130	12.8	157.	186.	39212.	5698.	3	B	.41.
W	111	8730- 8810	80	12.8	160.	189.	54731.	5837.	3	B	.54.
W	111	8850- 8910	60	12.8	161.	191.	42228.	5911.	3	B	.44.
W	111	9000- 9300	300	12.8	164.	195.	48972.	6090.	3	B	.50.
W	111	9370- 9410	40	12.8	167.	198.	48954.	6250.	3	B	.50.
W	111	9590-10530	940	12.8	176.	208.	59857.	6696.	3	B	.58.
W	111	10675-10730	55	12.8	184.	217.	66692.	7124.	3	B	.62.
W	111	10850-11005	155	12.8	187.	220.	71312.	7273.	3	B	.65.
W	111	8670- 8125	-545	12.5	179.	208.	55017.	5458.	3	HP	.41.
W	111	8265- 8440	175	12.5	179.	208.	84037.	5429.	3	HP	.60.
W	111	8485- 8570	85	12.5	180.	210.	71759.	5543.	3	HP	.52.
W	111	8605- 9150	545	12.5	184.	213.	92547.	5770.	3	HP	.64.
W	111	9220- 9825	605	12.5	190.	221.	72112.	6190.	3	HP	.52.
W	111	9875- 9970	95	12.5	193.	225.	47579.	6450.	3	HP	.35.
W	111	10040-10320	280	13.0	197.	229.	50721.	6882.	4	HP	.32.
W	111	10440-10505	65	13.0	201.	234.	70454.	7079.	4	HP	.45.
W	111	10565-10595	30	13.0	203.	236.	65465.	7152.	4	HP	.42.
W	111	10675-10920	245	13.0	207.	239.	74078.	7299.	4	HP	.48.
W	112	8670- 6125	-545	12.5	179.	208.	55017.	5458.	3	HP	.41.
W	112	8265- 8440	175	12.5	179.	208.	84037.	5429.	3	HP	.60.
W	112	8485- 8570	85	12.5	180.	210.	71759.	5543.	3	HP	.52.
W	112	8605- 9150	545	12.5	184.	213.	92547.	5770.	3	HP	.64.
W	112	9220- 9825	605	12.5	190.	221.	72112.	6190.	3	HP	.52.
W	112	9875- 9970	95	12.5	193.	225.	47579.	6450.	3	HP	.35.
W	112	10040-10320	280	13.0	197.	229.	50721.	6882.	4	HP	.32.
W	112	10440-10505	65	13.0	201.	234.	70454.	7079.	4	HP	.45.
W	112	10565-10595	30	13.0	203.	236.	65465.	7152.	4	HP	.42.
W	112	10675-10920	245	13.0	207.	239.	74078.	7299.	4	HP	.48.
W	140	8040- 8050	10	10.6	156.	184.	25594.	4434.	4	B	.60.
W	140	8155- 8200	45	10.6	157.	185.	27740.	4507.	4	B	.62.
W	140	8300- 8310	10	10.6	158.	186.	41210.	4578.	4	B	.75.
W	140	8355- 8425	70	10.2	158.	187.	11753.	4450.	5	B	.42.
W	140	9230- 9350	120	10.5	162.	193.	43033.	5072.	6	B	.78.
W	140	9390- 9475	85	10.5	164.	194.	15970.	5150.	6	B	.48.
W	141	8010- 8055	45	12.7	175.	203.	39731.	5305.	1	C	.40.

W	141	8090. 8115	25	12.7	176.	205.	39717.	5351.	1	C	.40.
W	141	8180. 8200	20	12.7	177.	206.	39701.	5409.	1	C	.40.
W	141	8250. 8330	80	12.7	179.	207.	58952.	5475.	1	C	.55.
W	141	8430. 8445	15	12.7	180.	209.	34705.	5572.	1	C	.35.
W	141	8470. 8500	30	12.7	181.	210.	54992.	5603.	1	C	.52.
W	141	8515. 8575	60	12.7	182.	211.	54999.	5643.	1	C	.52.
W	141	8700. 8750	50	12.7	184.	214.	45953.	5762.	1	C	.45.
W	141	8800. 8820	20	12.7	185.	215.	24348.	5818.	1	C	.25.
W	141	8875. 9175	300	12.7	188.	218.	78634.	5960.	1	C	.68.
W	141	9335. 9435	100	12.7	192.	223.	67277.	6198.	1	C	.60.
W	141	9475. 9505	30	12.7	194.	225.	37662.	6267.	1	C	.38.
W	141	9580. 9725	145	12.7	196.	227.	42369.	6375.	1	C	.42.
W	141	10050.10240	190	12.7	201.	233.	44871.	6700.	2	C	.40.
W	141	10500.10780	280	12.7	208.	240.	49888.	7027.	2	C	.45.
W	141	10830.10910	80	12.7	211.	243.	25947.	7179.	2	C	.24.
W	141	11025.11205	180	16.0	213.	246.	56178.	9248.	3	L	.31.
W	141	11635.11695	60	16.0	220.	253.	48105.	9705.	3	L	.25.
W	141	12005.12060	55	16.0	224.	257.	57823.	10011.	3	L	.33.
W	141	12130.12190	60	16.0	225.	259.	64869.	10117.	3	L	.38.
W	141	12255.12440	185	16.0	228.	261.	59793.	10273.	3	L	.35.
W	141	13090.13280	190	17.8	251.	284.	13079.	12204.	4	L	.22.
W	141	13440.13560	120	17.8	261.	294.	17714.	12496.	4	L	.32.
W	141	13820.13925	105	17.8	272.	304.	22949.	12840.	5	L	.29.
W	141	14230.14490	260	17.8	280.	311.	27206.	13292.	5	L	.35.
W	141	14685.14840	155	17.8	287.	318.	24520.	13664.	5	L	.32.
W	141	14980.15065	85	17.8	289.	319.	30075.	13905.	6	L	.32.
W	142	7870. 8380	510	10.6	165.	193.	82144.	4478.	6	I	.100.
W	142	8410. 8460	50	10.6	168.	197.	39799.	4649.	6	I	.70.
W	142	8505. 8560	55	10.6	169.	198.	241605.	4703.	6	I	.160.
W	142	8590. 8610	20	10.6	169.	198.	51827.	4740.	6	I	.80
W	142	8655. 8680	25	10.6	169.	199.	58859.	4778.	6	I	.85.
W	142	8730. 8755	25	10.6	170.	199.	92122.	4819.	6	I	.105.
W	142	8850. 9230	380	11.1	171.	201.	194190.	5218.	7	I	.140.
W	142	9295. 9505	210	11.1	174.	205.	125041.	5426.	8	I	.115.
W	142	9540.10140	600	12.5	179.	211.	139527.	6396.	9	I	.110.
W	142	10170.10315	145	12.5	184.	216.	53079.	6658.	9	I	.65.
W	142	10440.10570	130	11.6	187.	220.	72100.	6337.	10	I	.105.
W	142	10640.10800	160	11.6	189.	222.	16359.	6466.	10	I	.55.
W	142	10835.11080	245	11.1	203.	235.	13202.	6325.	11	I	.60.
W	142	11200.11215	15	11.1	227.	260.	12115.	6469.	11	I	.60.
W	142	11290.11325	35	11.1	236.	269.	14283.	6527.	11	I	.65.
W	142	11390.11680	490	11.2	237.	270.	41431.	6776.	12	I	.70.
W	142	11900.12270	370	12.6	256.	289.	48629.	7918.	13	I	.65.
W	146	7930. 8000	70	12.0	169.	197.	94277.	4970.	1	U	.39.
W	146	8070. 8280	210	12.0	172.	200.	108202.	5101.	1	U	.45.
W	146	8325. 8475	150	12.0	175.	204.	92821.	5242.	1	U	.38.
W	146	8545. 8625	80	12.0	177.	206.	96860.	5357.	1	U	.40.
W	146	8650. 8795	145	12.0	178.	208.	70979.	5443.	1	U	.25.
W	146	8820. 9170	350	12.0	182.	212.	87604.	5613.	1	U	.35.
W	146	9220. 9300	80	12.0	185.	215.	97719.	5778.	1	U	.40.
W	146	9335. 9445	110	12.0	186.	217.	77259.	5859.	1	U	.29.
W	146	9580. 9640	60	12.0	189.	220.	71969.	5997.	1	U	.25.
W	146	10180.10265	85	12.2	197.	230.	65915.	6485.	2	U	.25.
W	146	10300.10430	130	12.2	201.	233.	70822.	6576.	2	U	.28.
W	146	10480.10821	341	12.2	209.	241.	79493.	6757.	2	U	.35.
W	286	8020. 8035	15	11.1	165.	193.	54582.	4633.	3	H	.45.
W	286	8080. 8105	25	11.1	166.	194.	31448.	4671.	3	H	.25.
W	286	8135. 8165	30	11.1	166.	195.	36896.	4704.	3	H	.30.
W	286	8365. 8400	35	11.1	169.	198.	56028.	4838.	3	H	.46.
W	286	9395. 9475	80	10.8	183.	214.	22623.	5299.	4	H	.15.
W	286	9495. 9635	140	10.8	185.	217.	75039.	5372.	4	H	.58.
W	286	9720.10435	715	12.1	191.	223.	113322.	6341.	6	H	.45.
W	286	10455.10870	415	12.1	202.	234.	92744.	6709.	6	H	.35.
W	286	10920.11004	84	12.1	205.	238.	100710.	6897.	6	H	.40.
KE	16	8360. 8580	220	11.0	171.	200.	99645.	4845.	7	H	.45.
KE	16	8530. 8650	20	11.0	172.	202.	71734.	4942.	7	H	.29.

KE	16	8675. 9080	405	11.0	175.	205.	87695.	5078.	8	P	.51.
KE	16	9130. 9160	30	11.0	175.	208.	81464.	5231.	8	P	.48.
KE	16	9200. 9230	30	11.0	178.	209.	58810.	5271.	8	P	.33.
KE	16	9280. 9300	20	11.0	177.	210.	42054.	5314.	8	P	.20.
KE	16	9450. 9845	395	11.8	204.	235.	120773.	5920.	9	H	.59.
KE	16	9900.10160	260	12.1	203.	235.	128452.	6311.	10	H	.68.
KE	16	10240.10670	430	12.2	227.	259.	102049.	6633.	11	H	.62.
KE	16	10720.10730	10	12.2	229.	261.	58494.	6804.	11	H	.34.
KE	16	10760.10780	20	12.2	229.	262	53499.	6832.	11	H	.30.
KE	16	10830.10940	110	12.2	230.	263.	97398.	6905.	11	H	.60.
KE	16	10970.11140	170	12.3	232.	265.	82747.	7071.	12	H	.52.
KE	16	11170.11560	390	12.1	235.	268.	59185.	7151.	13	H	.45.
KE	16	11590.11650	260	12.1	238.	271.	58788.	7374.	13	H	.45.
KE	16	11880.11940	60	12.1	240.	273.	52602.	7494.	13	H	.40.
KE	25	7870. 8480	610	11.2	165.	193.	115449.	4761.	8	H	.80.
KE	25	8545. 8565	20	11.2	168.	195.	61833.	4982.	8	H	.52.
KE	25	8585. 8695	110	11.2	169.	199.	71537.	5032.	8	H	.55.
KE	25	8730. 8865	135	11.2	171.	201.	75713.	5124.	8	H	.61.
KE	25	8885. 9260	375	11.2	172.	203.	94922.	5284.	9	H	.58.
KE	25	9330. 9520	190	11.4	174.	205.	50063.	5587.	10	H	.34.
KE	25	9560. 9575	15	11.4	175.	207.	39572.	5672.	10	H	.25.
KE	25	9600. 9620	20	11.4	176.	207.	43210.	5697.	10	H	.28.
KE	25	9710. 9790	80	11.4	176.	208.	43223.	5780.	10	H	.28.
KE	25	9865. 9895	30	11.4	177.	208.	44478.	5857.	10	H	.29.
KE	25	9925. 9965	40	11.4	177.	208.	45696.	5895.	10	H	.30.
KE	28	7805. 8540	735	11.4	179.	208.	94108.	4845.	4	H	.58.
KE	28	8590. 8605	15	11.1	185.	214.	55764.	4962.	5	H	.39.
KE	28	8655. 8780	125	11.1	186.	216.	97195.	5032.	5	H	.64.
KE	28	8815. 9000	185	11.1	189.	219.	111278.	5141.	5	H	.70.
KE	28	9105. 9140	35	11.0	190.	221.	75663.	5218.	6	H	.45.
KE	28	9170. 9670	500	11.0	191.	221.	109103.	5388.	6	H	.62.
KE	28	9700.10010	310	11.7	195.	229.	122492.	5996.	7	H	.67.
KE	28	10050.10320	270	11.7	198.	230.	101830.	6197.	7	H	.38.
KE	28	10350.10650	300	11.7	201.	233.	95663.	6388.	8	H	.58.
KE	28	10645.11170	525	11.7	208.	240.	91688.	6636.	8	H	.57.
KE	28	11200.11520	320	11.0	212.	245.	58967.	6498.	9	HX	.52.
KE	28	11550.11575	25	11.0	215.	248.	32619.	6614.	9	HX	.30.
KE	28	11605.11770	165	11.0	216.	249.	49346.	6685.	9	HX	.45.
KE	28	11840.11855	15	11.0	217.	251.	33583.	6777.	9	HX	.31.
KE	28	11880.12000	120	11.0	218.	252.	51639.	6830.	9	HX	.47.
KE	29	7910. 7990	80	11.1	156.	184.	40247.	4589.	2	L	.38.
KE	29	8025. 8390	365	11.1	158.	186.	49134.	4737.	2	L	.46.
KE	29	8425. 8575	150	11.1	160.	189.	41192.	4906.	2	L	.39.
KE	29	8605. 9000	395	11.1	162.	192.	54850.	5081.	2	L	.50.
KE	29	9025. 9705	680	11.4	176.	207.	72277.	5552.	3	LX	.62.
KE	29	9730. 9770	40	11.4	189.	220.	54288.	5780.	3	LX	.50.
KE	29	9800.10190	390	11.4	197.	229.	49963.	5925.	3	LX	.47.
KE	29	10220.10360	140	11.6	197.	229.	48955.	6207.	4	LX	.47.
KE	29	10390.10615	225	11.6	211.	243.	48117.	6335.	4	LX	.47.
KE	29	10680.10850	170	11.6	216.	248.	51105.	6493.	4	LX	.50.
KE	29	10880.11010	130	11.6	219.	251.	43001.	6602.	4	LX	.43.
KE	29	11040.11410	370	11.6	223.	256.	40102.	6771.	4	LX	.41.
KE	29	11490.11570	80	12.5	226.	259.	72590.	7494.	5	LX	.52.
KE	29	11605.11720	115	12.5	230.	263.	43692.	7581.	5	LX	.30.
KE	29	11750.11800	50	12.5	231.	264.	72973.	7654.	5	LX	.53.
KE	29	11825.11920	95	12.5	232.	265.	67340.	7717.	5	LX	.49.
KE	29	11950.12710	760	12.5	239.	272.	55291.	8014.	6	L	.35.
KE	29	12740.12970	230	12.5	245.	278.	54788.	8356.	6	L	.35.
KE	29	13050.13140	90	12.5	249.	281.	46673.	8512.	6	L	.28.
KE	29	13220.13305	85	12.5	251.	284.	57672.	8621.	6	L	.38.
KE	29	13340.13470	130	12.5	253.	286.	47487.	8713.	6	L	.29.
KE	29	13570.13610	40	12.5	256.	288.	45419.	8833.	6	L	.27.
KE	29	13635.13925	290	12.5	259.	291.	48272.	8957.	6	L	.30.
KE	29	14050.14240	190	12.0	265.	296.	38563.	8826.	7	CL	.20.
KE	29	14440.14460	20	12.0	275.	301.	36687.	9017.	7	CL	.14.
KE	29	15150.15210	60	13.5	282.	312.	48291.	10656.	9	CL	.18.

KE 39	7975. 8005	30	10.9	168.	196.	31112.	4529.	2	HP	.30.
KE 39	8180. 8200	20	10.9	170.	199.	28987.	4642.	2	HP	.28.
KE 39	8225. 8245	20	10.9	171.	199.	34432.	4668.	2	HP	.33.
KE 39	8275. 8295	20	10.9	171.	200.	36616.	4696.	2	HP	.35.
KE 39	8320. 8385	65	10.9	172.	201.	38517.	4734.	2	HP	.37.
KE 39	8555. 8775	220	12.0	175.	205.	44200.	5407.	3	HX	.45.
KE 39	8830. 8840	10	12.0	177.	207.	59716.	5513.	3	HX	.57.
KE 39	8890. 8915	25	12.0	178.	208.	46612.	5555.	3	HX	.47.
KE 39	8975. 8985	10	12.0	179.	209.	24834.	5604.	3	HX	.27.
KE 39	9150. 9160	10	12.0	181.	211.	29418.	5713.	3	HX	.32.
KE 39	9190. 9330	140	12.0	182.	213.	59718.	5778.	3	HX	.57.
KE 39	9380. 9705	325	12.0	185.	216.	64890.	5955.	3	HX	.60.
KE 39	9750. 9770	20	12.0	187.	219.	25434.	6090.	3	HX	.28.
KE 39	9860. 9900	40	12.0	189.	220.	61460.	6165.	3	HX	.58.
KE 39	9940. 9960	20	12.0	189.	221.	57257.	6209.	3	HX	.55.
KE 39	10001.10090	89	14.0	192.	223.	73341.	7313.	5	HP	.48.
KE 39	10140.10200	60	14.0	196.	228.	91093.	7404.	5	HP	.58.
KE 39	10250.10350	100	14.0	200.	233.	73893.	7498.	5	HP	.48.
KE 39	10390.10555	165	14.0	206.	239.	114463.	7624.	5	HP	.70.
KE 39	10600.10935	335	14.0	217.	249.	47844.	7839.	5	HP	.31.
KE 39	11730.11760	30	15.5	243.	276.	77189.	9466.	6	HP	.22.
KE117	8330. 8525	195	12.0	155.	184.	43231.	5259.	5	R	.41.
KE117	8655. 8680	25	12.0	157.	187.	36058.	5409.	5	R	.34.
KE117	8800. 9065	265	12.6	168.	199.	44448.	5853.	6	P	.37.
KE117	9095. 9120	25	12.6	163.	193.	43301.	5967.	6	P	.36.
KE117	9150. 9190	40	12.6	164.	195.	34914.	6008.	6	P	.28.
KE117	9270. 9340	70	12.6	168.	199.	31385.	6097.	6	P	.25.
KE117	9400. 9800	400	12.6	175.	207.	61848.	6290.	6	P	.50.
KE117	9860. 9900	40	12.6	183.	214.	75856.	6473.	6	P	.59.
KE117	9925.10060	135	13.4	176.	208.	49215.	6963.	7	P	.41.
KE117	10145.10165	20	13.4	187.	219.	33604.	7076.	7	P	.27.
KE117	10210.10335	125	13.4	188.	220.	46152.	7158.	7	P	.38.
KE117	10370.10490	120	13.4	189.	221.	37819.	7268.	7	P	.31.
KE117	10680.10850	170	13.4	191.	223.	72054.	7501.	7	P	.56.
KE117	10930.10960	30	13.4	192.	225.	65916.	7626.	7	P	.52.
KE117	10990.11030	40	15.0	192.	225.	60252.	8588.	8	P	.46.
KE117	11100.11360	260	15.0	195.	228.	49393.	8759.	8	P	.38.
KE117	11455.11550	95	15.0	198.	231.	38695.	8972.	8	P	.29.
KE117	11605.11640	35	15.0	200.	233.	67503.	9066.	8	P	.50.
KE117	11670.11880	210	15.0	202.	235.	74783.	9184.	8	P	.55.
KE117	11975.12310	335	15.6	213.	246.	95547.	9850.	10	P	.52.
KE117	12340.12440	100	15.6	214.	247.	88184.	10051.	10	P	.48.
KE117	12490.12530	40	15.6	216.	250.	77216.	10148.	10	P	.42.
KE117	12600.12655	55	15.6	219.	252.	67224.	10243.	10	P	.35.
KE117	12760.12820	60	15.6	223.	256.	46931.	10375.	10	P	.20.
KE117	12850.12910	60	15.6	225.	258.	51163.	10448.	10	P	.24.
KE118	8330. 8570	240	12.7	169.	198.	88979.	5580.	2	H	.47.
KE118	8650. 8970	320	12.7	173.	203.	73903.	5818.	2	H	.38.
KE118	9005. 9050	45	12.7	176.	206.	64908.	5962.	2	H	.32.
KE118	9170. 9230	60	12.7	178.	208.	71267.	6076.	2	H	.36.
KE118	9330. 9375	45	12.7	179.	210.	57400.	6176.	2	H	.27.
KE118	9485. 9830	345	12.9	188.	219.	78299.	6478.	3	H	.37.
KE118	9890.10115	225	12.9	192.	224.	94324.	6710.	3	H	.45.
KE118	10150.10170	20	12.9	195.	227.	62515.	6815.	3	H	.26.
KE118	10200.10229	29	12.9	197.	229.	91197.	6852.	3	H	.43.
KE167	7880. 7995	115	12.1	173.	201.	46402.	4994.	2	LP	.37.
KE167	8095. 8105	10	12.1	175.	203.	32995.	5097.	2	LP	.25.
KE167	8125. 8145	20	12.1	175.	204.	31765.	5119.	2	LP	.24.
KE167	8205. 8235	30	12.1	176.	205.	28642.	5172.	2	LP	.21.
KE167	8290. 8300	10	12.1	177.	206.	48713.	5219.	2	LP	.39.
KE167	8445. 8520	75	12.1	179.	208.	51294.	5337.	2	LP	.41.
KE167	8575. 8600	25	12.1	180.	209.	44130.	5403.	2	LP	.35.
KE167	8860. 8870	10	12.1	183.	213.	40285.	5578.	2	LP	.32.
KE167	8895. 9050	155	12.1	184.	214.	51470.	5645.	2	LP	.41.
KE167	9075. 9150	75	12.1	186.	216.	47834.	5734.	2	LP	.38.
KE167	9180. 9240	60	12.1	187.	217.	38327.	5795.	2	LP	.30.

KE167	9300. 9365	65	12.1	188.	219.	33025.	5872.	2	LP	.25.
KE167	9440. 9955	515	12.1	192.	223.	68374.	6102.	2	LP	.52.
KE167	10000.10220	220	12.1	196.	228.	61936.	6361.	2	LP	.45.
KE167	10250.10550	300	16.8	211.	243.	36567.	9085.	3	L	.43.
KE167	10795.10945	150	16.8	208.	241.	46205.	9496.	3	L	.51.
KE167	11080.11325	245	16.8	216.	249.	37316.	9787.	3	L	.44.
KE167	11510.11590	80	16.8	224.	257.	16290.	10090.	3	L	.19.
KE167	11650.11885	235	16.8	229.	262.	29619.	10260.	3	L	.38.
KE167	11980.11990	10	16.8	234.	267.	.9251.	10470.	3	L	.25.
KE167	12250.12450	200	17.0	240.	273.	32769.	10917.	4	L	.23.
KE167	12580.12690	110	17.0	245.	278.	29255.	11169.	4	L	.20.
KE167	12890.13140	250	17.2	257.	290.	28673.	11641.	5	L	.22.
KE167	13330.13555	225	17.6	261.	293.	29211.	12303.	6	L	.25.
KE168	8040. 8085	45	12.5	176.	204.	35402.	5241.	2	DP	.32.
KE168	8230. 8315	85	12.5	178.	206.	31754.	5377.	2	DP	.29.
KE168	8400. 8635	235	12.5	180.	209.	57136.	5536.	2	DP	.50.
KE168	8675. 8800	125	12.5	182.	212.	46628.	5679.	2	DP	.42.
KE168	8830. 8960	130	12.5	184.	214.	57191.	5782.	2	DP	.50.
KE168	8995. 9010	15	12.5	185.	215.	38310.	5852.	2	DP	.35.
KE168	9065. 9170	105	12.5	186.	217.	45520.	5926.	2	DP	.41.
KE168	9270. 9330	60	12.5	188.	219.	72687.	6045.	2	DP	.60.
KE168	9430. 9620	190	15.8	211.	242.	120244.	7826.	3	DP	.75.
KE168	9680. 9870	190	15.8	196.	230.	102317.	8031.	3	DP	.65.
KE168	9930.10010	80	15.8	204.	235.	49339.	8191.	3	DP	.33.
KE168	10140.10220	80	15.8	210.	242.	36341.	8364.	3	DP	.22.
KE168	10315.10380	65	15.8	215.	247.	36237.	8502.	3	DP	.22.
KE168	10460.10495	35	15.8	218.	251.	33883.	8608.	3	DP	.20.
KE168	11200.11380	180	17.5	238.	271.	24655.	10274.	4	DP	.33.
KE168	12480.12540	60	17.5	261.	294.	29792.	11384.	5	DP	.26.
KE173	7790. 8155	365	10.8	169.	197.	79143.	4477.	8	H	.56.
KE173	8210. 8390	180	10.8	172.	201.	85142.	4661.	8	H	.59.
KE173	8455. 8495	40	11.1	174.	203.	56102.	4892.	9	H	.38.
KE173	8525. 8575	50	11.1	174.	204.	61777.	4935.	9	H	.42.
KE173	8600. 8620	20	11.1	175.	204.	49042.	4970.	9	H	.33.
KE173	8650. 9120	470	11.2	177.	207.	100302.	5175.	11	H	.60.
KE173	9170. 9350	180	11.1	179.	210.	32578.	5345.	12	H	.46.
KE173	9385. 9400	15	11.1	180.	211.	13347.	5421.	12	H	.21.
KE173	9420. 9605	185	11.1	181.	212.	28180.	5491.	12	H	.42.
KE173	9645. 9710	65	11.1	182.	213.	24527.	5586.	12	H	.38.
KE173	9740. 9920	180	11.5	183.	215.	22358.	5878.	13	H	.32.
KE173	9960.10100	140	11.5	186.	217.	33321.	5998.	13	H	.44.
KE173	10135.10555	420	12.2	189.	221.	41788.	6563.	14	H	.45.
KE173	10585.11030	445	14.1	194.	227.	104204.	7924.	15	SH	.52.
KE173	11125.11460	335	14.1	199.	232.	70543.	8260.	15	SH	.33.
KE173	11490.11585	95	14.2	202.	235.	51919.	8519.	16	H	.45.
KE173	11630.11645	15	14.2	204.	237.	38367.	8593.	16	H	.34.
KE173	11695.11985	290	14.2	209.	242.	57989.	8743.	16	H	.50.
KE174	7890. 8100	210	10.7	158.	187.	54584.	4448.	4	AGH	.38.
KE174	8125. 8260	135	10.7	162.	190.	65333.	4558.	4	AGH	.45.
KE174	8290. 8500	210	10.8	169.	198.	108874.	4715.	5	AGH	.70.
KE174	8550. 8670	120	10.8	171.	200.	80399.	4835.	5	AGH	.57.
KE174	8720. 8830	110	10.8	176.	205.	82805.	4928.	5	AGH	.58.
KE174	8910. 9230	320	11.7	173.	203.	99299.	5518.	6	I	.55.
KE174	9280. 9510	230	11.7	181.	212.	96125.	5716.	6	I	.53.
KE174	9540. 9750	210	11.5	186.	217.	112003.	5768.	7	H	.57.
KE174	9780. 9945	165	11.5	184.	216.	92039.	5898.	7	H	.48.
KE174	10010.10140	130	12.1	186.	218.	92499.	6339.	8	H	.50.
KE174	10180.10300	120	12.1	190.	223.	59674.	6443.	9	H	.32.
KE174	10340.10610	270	12.1	192.	224.	63237.	6591.	9	H	.34.
KE174	10640.10780	140	12.1	196.	229.	66924.	6739.	9	H	.36.
KE174	10860.11015	155	12.1	200.	232.	123838.	6882.	10	H	.57.
KE174	11120.11150	30	12.1	202.	235.	107721.	7006.	10	H	.50.
KE174	11075.11650	575	12.0	207.	240.	156527.	7090.	11	H	.58.
KE174	11740.11940	200	12.0	215.	248.	115582.	7388.	11	H	.41.
KE353	8370. 8595	225	10.9	165.	194.	38373.	4808.	1	R	.42.
KE353	[illegible]	430	11.7	167.	197.	[illegible]	5342.	2	R	.40.

KE353	9100-9140	40	11.7	171.	202.	41772.	5549.	2	R	.27.
KE353	9205-9240	35	11.7	172.	203.	49905.	5611.	2	R	.34.
KE353	9290-9315	25	11.7	173.	204.	32120.	5660.	2	R	.18.
KE353	9350-9420	70	11.7	174.	205.	39496.	5710.	2	R	.25.
KE353	9480-9850	370	11.7	177.	208.	61654.	5880.	2	R	.42.
KE353	9940-10019	79	11.7	180.	211.	72889.	6072.	2	R	.49.
KE408	8570-8780	210	11.5	169.	199.	52615.	5188.	1	K	.56.
KE408	8890-9690	800	11.5	176.	206.	106048.	5555.	1	K	.87.
KE408	9730-10260	530	11.5	183.	215.	96717.	5977.	1	K	.83.
KE408	10330-10460	130	11.5	188.	220.	62622.	6216.	1	K	.63.
KE408	10560-10590	30	11.5	190.	222.	21792.	6324.	1	K	.27.
KE408	11030-11070	40	11.5	195.	228.	20967.	6608.	1	K	.26.
KE408	11340-11355	15	11.5	198.	231.	17714.	6786.	1	K	.21.
N 17	8000-8015	15	11.7	165.	193.	38857.	4872.	2	DP	.27.
N 17	8115-8130	15	11.7	166.	195.	36936.	4942.	2	DP	.25.
N 17	8300-8335	35	11.7	168.	197.	38810.	5060.	2	DP	.27.
N 17	8380-8400	20	11.7	169.	198.	36906.	5104.	2	DP	.25.
N 17	8435-8510	75	11.7	170.	199.	42022.	5155.	2	DP	.30.
N 17	8540-8610	70	11.7	171.	200.	31264.	5217.	2	DP	.20.
N 17	8760-8890	130	11.7	173.	203.	32346.	5369.	2	DP	.21.
N 17	8930-8965	35	11.7	174.	204.	33524.	5444.	2	DP	.22.
N 17	9065-9075	10	14.5	176.	206.	67171.	6839.	3	DP	.34.
N 17	9095-9120	25	14.5	177.	207.	88263.	6867.	3	DP	.47.
N 17	9180-9210	30	14.5	179.	209.	73305.	6933.	3	DP	.38.
N 17	9260-9280	20	14.5	181.	211.	65833.	6990.	3	DP	.33.
N 17	9440-9460	20	14.5	185.	216.	52652.	7125.	3	DP	.24.
N 17	9590-9655	65	14.5	189.	220.	61328.	7255.	3	DP	.30.
N 54	7990-8095	105	10.0	162.	190.	45169.	4182.	2	P	.80.
N 54	8145-8195	50	10.5	167.	196.	60688.	4461.	3	HP	.42.
N 54	8260-8520	260	10.5	167.	196.	67545.	4581.	3	HP	.46.
N 54	8560-8830	270	12.5	170.	200.	69284.	5652.	4	HP	.52.
N 54	8865-8880	15	12.3	173.	203.	38277.	5767.	4	HP	.29.
N 54	9040-9105	65	13.0	176.	206.	61424.	6133.	5	HP	.45.
N 54	9145-9410	265	13.0	178.	208.	66598.	6272.	5	HP	.48.
N 54	9450-9470	20	13.0	180.	211.	46738.	6395.	5	HP	.34.
N 54	9540-9595	55	13.0	182.	213.	47907.	6468.	5	HP	.35.
N 54	9630-9715	85	13.0	183.	214.	28575.	6539.	5	HP	.18.
N 54	9740-9820	80	13.0	184.	216.	47996.	6611.	5	HP	.35.
N 54	9910-10005	95	13.0	187.	219.	60848.	6731.	6	HP	.29.
N 54	10470-10580	110	13.0	199.	231.	73226.	7115.	6	HP	.36.
N 55	7550-8750	1200	11.0	173.	202.	127296.	4662.	2	YPG	.100.
N 55	8815-8975	160	11.0	182.	212.	117871.	5088.	2	YPG	.96.
N 55	9345-9400	55	11.0	188.	219.	41236.	5361.	2	YPG	.51.
N 55	10170-10300	130	17.1	202.	234.	12506.	9101.	7	ARG	.28.
N 60	7790-8005	215	11.0	172.	199.	87146.	4517.	2	AE	.68.
N 60	8055-8210	155	11.0	175.	204.	72459.	4652.	2	AE	.59.
N 60	8270-8440	170	11.0	179.	208.	73920.	4779.	2	AE	.60.
N 60	8475-8595	120	11.0	182.	211.	69598.	4882.	2	AE	.57.
N 60	8635-8700	65	11.0	184.	214.	36370.	4958.	2	AE	.32.
N 60	8885-8915	30	13.5	187.	217.	73754.	6248.	3	AE	.45.
N 60	8950-9015	65	13.5	187.	217.	39049.	6306.	3	AE	.20.
N 60	9085-9165	80	13.5	188.	219.	113203.	6406.	3	AE	.65.
N 60	9255-9375	120	13.5	189.	220.	73929.	6539.	3	AE	.45.
N 195	8060-8480	420	12.1	181.	210.	96138.	5203.	1	D	.70.
N 195	8505-8520	15	12.1	185.	214.	48278.	5356.	1	D	.40.
N 195	8690-8710	20	12.1	187.	217.	48339.	5474.	1	D	.40.
N 195	8850-8960	110	12.1	190.	220.	59159.	5603.	1	D	.48.
N 195	9110-9170	60	12.1	193.	223.	65880.	5751.	1	D	.52.
N 195	9250-9385	135	12.1	195.	226.	72179.	5863.	1	D	.56.
N 195	9450-9800	350	16.3	201.	233.	91605.	8158.	2	GJY	.79.
N 195	9890-9910	20	16.3	208.	239.	39808.	8391.	2	GJY	.45.
N 195	9990-10190	200	16.3	212.	244.	20559.	8552.	2	GJY	.25.
N 195	10225-10290	65	16.3	216.	248.	46371.	8694.	2	GJY	.51.
N 195	10545-10580	35	16.3	224.	256.	23469.	8953.	2	GJY	.30.
N 195	13135-13150	15	17.1	272.	305.	36653.	11686.	4	D	.28.
N 198	7945-8010	65	12.1	177.	205.	95523.	5019.	1	C	.65.

N	198	8050.	8090	40	12.1	179.	207.	85509.	5078.	1	C	.60.
N	198	8140.	8320	180	12.1	181.	209.	85616.	5178.	1	C	.60.
N	198	8350.	8540	190	12.1	183.	212.	118757.	5314.	1	C	.75.
N	198	8570.	8600	30	12.1	185.	215.	85903.	5402.	1	C	.60.
N	198	8740.	8820	80	12.1	188.	217.	65369.	5524.	1	C	.47.
N	198	8920.	9000	80	12.1	190.	220.	74572.	5638.	1	C	.53.
N	198	9030.	9050	20	12.1	191.	221.	74625.	5688.	1	C	.53.
N	198	9030.	9050	20	12.1	191.	221.	74625.	5688.	1	C	.53.
N	198	9065.	9170	105	12.1	192.	222.	60367.	5737.	1	C	.44.
N	198	9220.	9310	90	12.1	194.	225.	77491.	5830.	1	C	.55.
N	198	9420.	9510	90	15.5	215.	246.	54775.	7629.	2	LC	.25.
N	198	9530.	9600	70	15.5	200.	231.	108329.	7709.	2	LC	.55.
N	198	9630.	9760	130	15.5	205.	236.	121989.	7814.	2	LC	.62.
N	198	9850.	9865	15	15.5	210.	241.	63693.	7945.	2	LC	.31.
N	198	10020.	10070	50	15.5	216.	248.	69259.	8096.	2	LC	.35.
N	198	10180.	10230	50	15.5	221.	253.	70053.	8225.	2	LC	.36.
N	198	10450.	10520	70	16.4	217.	249.	39363.	8942.	3	L	.39.
N	199	7900.	8080	180	13.8	174.	202.	123192.	5734.	1	CE	.60.
N	199	8215.	8410	195	13.8	178.	206.	104204.	5965.	1	CE	.52.
N	199	8440.	8630	190	13.8	180.	210.	99397.	6125.	1	CE	.50.
N	199	8720.	8750	30	13.8	183.	213.	90227.	6268.	1	CE	.45.
N	199	8890.	9020	130	13.8	186.	216.	96287.	6426.	1	CE	.48.
N	199	9050.	9065	15	13.8	187.	217.	73391.	6500.	1	CE	.35.
N	199	9225.	9265	40	13.8	189.	220.	78954.	6634.	1	CE	.39.
N	199	9315.	9400	85	15.8	191.	222.	100413.	7688.	2	G	.49.
N	199	9440.	9520	80	15.8	193.	224.	110768.	7789.	2	G	.53.
N	199	9600.	9660	60	15.8	196.	227.	108711.	7912.	2	G	.52.
N	199	9730.	9940	210	15.8	199.	231.	90478.	8060.	2	G	.43.
N	199	10110.	10240	130	15.8	205.	237.	93182.	8360.	2	G	.45.
N	199	10325.	10420	95	15.8	208.	241.	62892.	8522.	2	G	.27.
N	199	10480.	10550	70	15.8	211.	243.	73392.	8639.	2	G	.34.
N	199	10585.	10750	165	15.8	214.	246.	91043.	8764.	2	G	.45.
N	199	11215.	11265	50	16.2	224.	257.	21923.	9469.	3	G	.25.
N	199	11570.	11640	70	16.2	231.	264.	35911.	9776.	3	G	.40.
N	215	7960.	8070	110	12.2	171.	199.	66295.	5085.	1	OX	.31.
N	215	8105.	8180	75	12.2	172.	201.	59529.	5166.	1	OX	.47.
N	215	8430.	8470	40	12.2	176.	205.	48701.	5361.	1	DX	.39.
N	215	8515.	8590	75	12.2	177.	207.	54283.	5426.	1	DX	.43.
N	215	8670.	8755	85	12.2	179.	209.	48766.	5527.	1	OX	.39.
N	215	8800.	8840	40	17.1	181.	211.	32476.	7843.	2	DP	.42.
N	215	8865.	8910	45	17.1	183.	213.	23856.	7903.	2	DP	.33.
N	215	9190.	9220	30	17.1	193.	223.	24761.	8185.	2	DP	.35.
N	215	9280.	9335	55	17.1	196.	226.	23459.	8276.	2	DP	.33.
N	215	9480.	9580	100	17.1	202.	233.	31782.	8474.	2	DP	.42.
N	215	9640.	9720	80	17.1	207.	238.	22335.	8607.	2	DP	.32.
N	215	9770.	9845	75	17.1	211.	242.	20036.	8721.	2	DP	.29.
N	215	9895.	9940	45	17.1	214.	246.	19373.	8819.	2	DP	.28.
N	215	9990.	10100	110	17.1	218.	250.	23717.	8932.	2	DP	.35.
N	215	10250.	10410	160	16.8	207.	239.	33222.	9024.	3	DP	.40.
N	215	10530.	10650	120	16.8	228.	260.	37176.	9251.	3	DP	.45.
N	215	10950.	11050	100	16.8	228.	261.	21104.	9610.	3	DP	.28.
N	240	7910.	8065	155	11.6	156.	184.	59571.	4818.	1	GI	.60.
N	240	8160.	8225	65	11.6	158.	187.	46341.	4942.	1	GI	.50.
N	240	8260.	8290	30	11.6	159.	188.	46318.	4991.	1	GI	.50.
N	240	8325.	8420	95	11.6	160.	189.	72450.	5050.	1	GI	.68.
N	240	8455.	8520	65	11.6	161.	191.	75169.	5120.	1	GI	.70.
N	240	8665.	8710	45	11.6	163.	193.	37526.	5240.	1	GI	.42.
N	240	8740.	8805	65	11.6	164.	194.	38442.	5292.	1	GI	.43.
N	240	8850.	8930	80	11.6	166.	196.	52376.	5362.	1	GI	.55.
N	240	9000.	9070	70	15.0	168.	199.	114125.	7047.	2	UI	.62.
N	240	9130.	9150	20	15.0	171.	201.	64689.	7129.	2	U2	.36.
N	240	9210.	9225	15	15.0	172.	203.	49770.	7190.	2	U2	.26.
N	240	9280.	9295	15	15.0	174.	205.	57138.	7244.	2	U2	.31.
N	240	9975.	10020	45	15.0	190.	222.	48487.	7798.	2	U2	.24.
N	240	10135.	10200	65	15.0	194.	226.	52742.	7931.	2	U2	.27.
N	240	10465.	10500	35	15.0	201.	234.	53136.	8176.	2	U2	.27.

N 275	7990. 8270	280	12.5	171.	199.	66893.	5284.	1	K .64.
N 275	8370. 8515	145	12.5	174.	203.	59019.	5468.	1	K .58.
N 275	8545. 8760	215	12.5	177.	206.	56409.	5624.	1	K .56.
N 275	8930. 8950	20	12.5	180.	210.	24453.	5811.	1	K .28.
N 275	9000. 9050	50	12.5	181.	211.	36833.	5866.	1	K .40.
N 275	9100. 9170	70	12.5	182.	213.	50510.	5938.	1	K .52.
N 275	9250. 9350	100	12.5	184.	215.	47128.	6045.	1	K .49.
N 275	10225.10270	45	16.4	211.	244.	20912.	8739.	2	K .24.
N 275	10400.10500	100	16.4	218.	250.	31974.	8912.	2	K .37.
N 275	10620.10740	120	16.4	224.	257.	29311.	9108.	2	K .35.
N 275	10860.10930	70	16.4	231.	264.	28046.	9291.	2	K .34.
N 277	7970. 8080	110	12.6	162.	190.	46016.	5258.	1	C .54.
N 277	8110. 8200	90	12.6	163.	191.	55079.	5343.	1	C .61.
N 277	8450. 8480	30	12.6	166.	195.	39043.	5546.	1	C .48.
N 277	8530. 8610	80	12.6	167.	197.	41064.	5615.	1	C .50.
N 277	8690. 8860	170	16.6	191.	221.	42942.	7575.	2	KC .58.
N 277	8885. 8920	35	16.6	173.	203.	24602.	7685.	2	KC .40.
N 277	9050. 9060	10	16.6	178.	208.	18153.	7816.	2	KC .31.
N 277	9210. 9250	40	16.6	183.	213.	20745.	7967.	2	KC .35.
N 277	9300. 9365	65	16.6	186.	217.	22836.	8056.	2	KC .38.
N 277	9430. 9455	25	16.6	189.	220.	16649.	8151.	2	KC .29.
N 277	9510. 9630	120	16.6	193.	224.	36107.	8261.	2	KC .52.
N 277	9690. 9790	100	16.6	198.	230.	26638.	8408.	2	KC .44.
N 277	9830. 9920	90	16.6	202.	234.	24616.	8524.	2	KC .42.
N 277	9970.10020	50	16.6	206.	237.	21282.	8628.	2	KC .37.
H 555	10062-10120	58	12.4	194.		23000.			
H 555	10184-10224	40	12.4	195		18200.			
H 555	10274-10354	80	12.4	196.		18200.			
H 555	10644-10692	48	12.4	200		13600			
H555	10696-10784	88	12.4	201.		13400.			
H555	10840-10884	44	12.4	202		13400			
H555	11448-11536	88	16.5	215		6300			
H555	11584-11674	90	16.5	216		4505			
H555	11618-11742	64	16.5	222.		5500			
H555	12055-12102	47	17.0	230.		7200.			
H555	14102-14128	26	17.0	255		5000			
H555	14208-14236	28	17.0	259		5500.			
H555	14330-14402	21	17.0	260		6500			
H555	14920-14946	26	17.0	279		7100			
C 2	10144-10184	40	12.0	[illegible]		16700			
C 2	10246-[illegible]	70	12.0	205		15300.			
C 2	10402-10468	66	12.0	[illegible]		47000			
C 2	10706-10756	50	12.0	217		13300.			
C 2	10934-10980	46	12.0	223		7000.			
C 2	11824-11890	66	14.5	242		14700.			
C 2	12858-12904	46	14.5	264		4000			
C 2	[illegible]-[illegible]140	[illegible]	14.5	267		5900			
C 2	[illegible]-13000	40	14.5	[illegible]		6300			
C 2	13030-13[illegible]	[illegible]	14.5	[illegible]		4500.			
C 2	13800-13[illegible]	[illegible]	[illegible]	[illegible]		11600.			
C 2	14300 [illegible]	[illegible]	15.3	[illegible]		6000.			

C 2	14426 - 14510	84	15.3	295	1800
C 2	14540 - 14570	30	15.3	296	5500
C 2	14650 - 14672	22	15.3	297	5300
C 2	14682 - 14720	38	15.3	298	5200
C 2	14748 - 14770	22	15.3	300	5000
C 177	9480 - 9600	120	11.6	197	142 000
C 177	9530 - 9970	70	11.6	203	44600
C 177	10560 - 10640	80	11.6	210	16300
C 177	12330 - 12380	50	14.5	239	16500
C 177	12430 - 12490	60	14.5	241	19000
C 177	12740 - 12780	40	14.5	247	16300
C 177	13450 - 13500	50	14.5	261	17900
C 177	13620 - 13720	100	14.5	265	16000
C 177	14440 - 14500	60	15.3	278	24600
C 177	14630 - 14920	290	15.3	284	15200
C 177	15345 - 15410	65	15.3	290	7000

APPENDIX 3

List of woody species comprising the chaparral of the Langoria Unit

Common Name	Scientific Name
Mesquite	*Prosopis chilensis*
Desert Hackberry	*Celtis pallida*
Prickly ash	*Zanthoxylum fagara*
Bluewood condalia	*Condalia obovata*
Lycium	*Lycium* spp.
Mexican persimmon	*Diospyros texana*
Ebony	*Pitecelobium flexicaule*
Coma	*Bumelia angustifolia*
Anaqua	*Ehretia anacua*
Prickly pear cactus	*Opuntia* spp.

APPENDIX 4

List of avian species commonly using Langoria Unit

Common Name	Scientific Name
Great-tailed grackle	*Cassidix mexicanus*
White-winged dove	*Zenaida asiatica*
Mourning dove	*Zenaidura macroura*
Ground dove	*Columbigallina passerina*
White fronted dove	*Leptotila verreauxi*
Inca dove	*Scardafella inca*
Bronze Cowbird	*Tegavius aeneus*
House sparrow	*Passer domesticus*
Mockingbird	*Mimus polyglottos*
Cardinal	*Richmondena cardinalis*
Lark sparrow	*Chondestes grammacus*
Killdeer	*Charadrius vociferus*

Appendix 5

Environmental Impact Matrix

for Sebastian Site

SEBASTIAN SITE

	NOISE & VIBRATION	BUILDINGS	PIPELINES	ROADS	FENCES	SURFACE EXCAVATIONS	WELL DRILLING & FLUID REMOVAL	ENERGY GENERATION	TAILINGS & OVERBURDEN	DEEP WELL WATER DISPOSAL	SURFACE WATER DISPOSAL	SEWAGE SYSTEM	BLOWOUT
LANDFORM	1/2	2/1	1/1	2/1	1/1	3/1	2/2	1/1	3/1	1/1	2/1	1/1	3/2
SOIL	1/2	2/1	1/1	2/1	1/1	3/1	2/1	1/1	3/1	1/1	3/1	1/1	3/2
SURFACE WATER	1/2	2/1	1/1	1/1	1/1	1/1	1/2	1/2	1/2	1/1	1/1	1/1	3/2
SEA WATER	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	2/3	1/3	3/2
UNDERGROUND WATER	1/2	1/1	1/1	1/1	1/1	1/1	3/3	1/1	1/1	3/3	4/2	1/1	4/2
ATMOSPHERIC QUALITY	3/2	1/1	1/1	1/1	1/1	1/1	3/2	1/1	1/1	1/1	3/2	1/1	4/2
MICRO-CLIMATES	UK/UK	2/1	2/1	2/1	2/1	1/1	1/1	3/1	2/1	1/1	3/2	1/1	4/2
FLOODS	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/1	1/1	3/2
EROSION	1/2	2/1	2/1	2/1	1/1	2/1	2/1	1/1	2/1	1/1	2/1	2/1	3/2
DEPOSITION	1/2	2/1	2/1	2/1	1/1	2/1	2/1	1/1	2/1	1/1	2/1	1/1	3/2
STRESS/STRAIN EARTHQUAKE	1/2	1/2	1/2	1/2	1/2	1/2	2/3	1/2	1/2	2/3	1/2	1/2	1/2
TREES	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/2
SHRUBS	1/2	1/1	2/1	2/1	2/1	2/1	2/1	1/1	2/1	2/1	1/1	2/1	3/2

SEBASTIAN SITE (cont.)

	NOISE & VIBRATION	BUILDINGS	PIPELINES	ROADS	FENCES	SURFACE EXCAVATIONS	WELL DRILLING & FLUID REMOVAL	ENERGY GENERATION	TAILINGS & OVERBURDEN	DEEP WELL WATER DISPOSAL	SURFACE WATER DISPOSAL	SEWAGE SYSTEM	BLOWOUT
GRASS	1 / 2	1 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	1 / 1	2 / 1	2 / 1	1 / 1	2 / 1	3 / 2
CROPS	1 / 2	4 / 1	2 / 1	3 / 1	1 / 1	3 / 1	3 / 1	1 / 1	3 / 1	1 / 1	3 / 1	2 / 1	4 / 2
MICRO-FLORA	1 / 2	1 / 1	2 / 1	2 / 1	2 / 1	2 / 1	2 / 1	1 / 1	2 / 1	2 / 1	1 / 1	2 / 1	4 / 1
AQUATIC PLANTS	1 / 2	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	2 / 3	1 /	4 / 3
ENDANGERED PLANT SPECIES	1 / 2	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 3	1 / 1	UK / 3
PLANT CORRIDORS	1 / 2	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 3	1 / 1	UK / 3
BIRDS	3 / 2	UK / 2	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	UK / 2	1 / 1	4 / 3
LAND ANIMALS	3 / 2	3 / 2	2 / 1	2 / 1	2 / 2	2 / 1	1 / 1	1 / 1	2 / 1	1 / 1	2 / 1	1 / 1	4 / 2
FISH-SHELLFISH	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	2 / 3	1 /	4 / 3
BENTHIC ORGANISMS	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	1 /	2 / 3	1 /	4 / 3
INSECTS	UK / 2	2 / 1	1 / 1	1 / 1	1 / 1	2 / 1	1 / 1	1 / 1	2 / 1	1 / 1	2 / 1	1 / 1	3 / 2
MICRO-FAUNA	UK / 2	2 / 1	1 / 1	1 / 1	1 / 1	2 / 1	1 / 1	1 / 1	2 / 1	1 / 1	2 / 1	1 / 1	4 / 2
ENDANGERED ANIMAL SPECIES	UK / 2	UK / 2	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	UK / 3	1 / 1	4 / 3

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Appendix 6

Environmental Impact Matrix

for Port Mansfield Site

PORT MANSFIELD SITE
(TENERIAS)

	NOISE & VIBRATION	BUILDINGS	PIPELINES	ROADS	FENCES	SURFACE EXCAVATIONS	WELL DRILLING & FLUID REMOVAL	ENERGY GENERATION	TAILINGS & OVERBURDEN	DEEP WELL WATER DISPOSAL	SURFACE WATER DISPOSAL	SEWAGE SYSTEM	BLOWOUT
LANDFORM	1/2	2/1	2/1	2/1	1/1	3/1	2/2	1/1	3/1	1/1	2/1	1/1	3/2
SOIL	1/2	3/1	3/1	3/1	1/1	3/1	2/1	1/1	3/1	1/2	3/1	1/1	3/2
SURFACE WATER	1/2	1/1	1/1	2/1	1/1	1/1	1/2	1/1	3/1	1/1	4/1	1/1	4/2
SEA WATER	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/3	1/2	3/3
UNDERGROUND WATER	1/2	2/1	1/1	1/1	1/1	1/1	3/3	1/1	1/1	3/3	3/3	2/2	3/3
ATMOSPHERIC QUALITY	3/2	1/1	1/1	1/1	1/1	1/1	1/1	2/1	1/1	1/1	3/2	1/1	4/2
MICRO-CLIMATES	UK/UK	2/1	2/1	2/1	2/1	1/1	1/1	3/1	2/1	1/1	3/2	1/1	3/2
FLOODS	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/2	1/1	3/2
EROSION	1/2	3/1	2/1	2/1	1/1	2/1	2/1	1/1	3/1	1/1	2/1	2/1	4/2
DEPOSITION	1/2	3/1	2/1	2/1	2/2	2/1	2/1	1/1	2/1	1/1	1/1	1/1	3/2
STRESS/STRAIN EARTHQUAKE	1/2	1/2	1/2	1/2	1/2	1/2	2/3	1/2	1/2	2/3	1/2	1/2	1/2
TREES	1/2	3/1	1/1	2/1	1/1	2/1	1/1	1/1	1/1	1/1	3/1	2/1	4/2
SHRUBS	1/2	3/1	2/1	2/1	2/1	3/1	2/1	1/1	3/1	1/1	3/1	2/1	4/2

PORT MANSFIELD SITE (cont.)
(TENERIAS)

	NOISE & VIBRATION	BUILDINGS	PIPELINES	ROADS	FENCES	SURFACE EXCAVATIONS	WELL DRILLING & FLUID REMOVAL	ENERGY GENERATION	TAILINGS & OVERBURDEN	DEEP WELL WATER DISPOSAL	SURFACE WATER DISPOSAL	SEWAGE SYSTEM	BLOWOUT
GRASS	1/2	3/1	2/1	2/1	2/1	3/1	2/1	1/1	3/1	1/1	3/1	2/1	4/2
CROPS	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/2
MICRO-FLORA	1/2	3/1	2/1	2/1	2/1	3/1	2/1	1/1	3/1	1/1	3/1	2/1	4/2
AQUATIC PLANTS	1/2	2/1	2/1	2/1	2/1	2/1	1/1	1/1	2/1	2/1	3/3	2/1	4/3
ENDANGERED PLANT SPECIES	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/2	1/1	1/3
PLANT CORRIDORS	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/3
BIRDS	3/2	2/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/1	1/1	3/2
LAND ANIMALS	3/2	3/2	2/1	2/1	2/2	1/1	1/1	1/1	1/1	1/1	2/1	1/1	3/2
FISH-SHELLFISH	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/3	1/1	3/3
BENTHIC ORGANISMS	1/2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/3	1/1	3/3
INSECTS	UK/2	2/1	1/1	1/1	1/1	2/1	1/1	1/1	2/1	1/1	2/1	1/1	3/2
MICRO-FAUNA	UK/2	2/1	1/1	1/1	1/1	2/1	1/1	1/1	2/1	1/1	2/1	1/1	3/2
ENDANGERED ANIMAL SPECIES	3/2	2/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	2/2	1/1	3/3